



UNIMETRICS, INC.

"DIGI SCAN-16"



16-CHANNEL 3 BAND CRYSTAL-CONTROLLED FM RECEIVER/SCANNERS

**LOW BAND 30- 50 MHz
HIGH BAND 150-174 MHz
UHF BAND 450-470 MHz**

UNIMETRICS, INC.

23 West Mall, Plainview N. Y. 11803

SPECIFICATIONS

FREQUENCY RANGE -----	This receiver can receive three bands if a desired crystal is inserted in it, as shown below. Ch. 1—Ch. 8 are exclusively for the UHF band, while Ch. 9—Ch. 16 are for the VHF band (VHF Low and VHF High). In this case, the crystal can be inserted in any channel ranging from Ch. 9—Ch. 16, regardless of whether the band is low or high. The frequency coverage in each band is as follows: (VHF low band) 30 to 50 MHz, total spread 5 MHz (VHF high band) 150 to 174 MHz, total spread 7 MHz (UHF band) 450 to 470 MHz, total spread 7 MHz
SENSITIVITY -----	0.5 μ V for 20 db quieting
SELECTIVITY -----	60 db down at $\pm$ 30 KHz
ANTENNA -----	50 ohms (impedance)
SIGNAL TO NOISE RATIO -----	30 db, 1 μ V, 1 KHz at 5 KHz deviation.
BANDWIDTH -----	$\pm$ 8 KHz (—6 db)
INTERMEDIATE FREQUENCY -----	1st IF—10.7 MHz, 2nd IF—455 KHz
SPURIOUS RESPONSE REJECTION -----	70 db
AUDIO OUTPUT -----	2 watts maximum (V.C. imp. 8 ohms) 10% Distortion
IMAGE RESPONSE REJECTION -----	More than 55 db
SCANNING RATE -----	Approx. 8~18 channels per sec. (Variable)
CURRENT DRAIN -----	Less than 500 milliamperes
POWER SOURCE -----	Operates from 11.5 to 14.5 volts DC Negative Ground only or AC 115—120 volts, 60 Hz
DIMENSIONS -----	Approx. 9- $\frac{3}{10}$ " (W) $\times$ 9- $\frac{3}{8}$ " (D) $\times$ 3- $\frac{1}{8}$ " (H)
NET WEIGHT -----	7.5 lbs

THESE RECEIVERS ARE SUPPLIED WITHOUT CRYSTALS. THE RECEIVER WILL BE INOPERATIVE UNLESS THE PROPER CRYSTALS ARE INSERTED WITHIN THE UNIT. CRYSTALS MUST BE INSERTED PRIOR TO OPERATION AS OUTLINED UNDER "INSTALLATION OF CRYSTALS."

Note 1 : Only the UHF card of the Digi Scan-8 or the Digi Scan 4+4 can be used for this new Digi Scan-16. You have only to change several hookup wires when the card is to be changed.

Note 2 : The crystal of the Digi Scan-8 or Digi Scan 4+4 can be used for this new Digi Scan-16.

GENERAL DESCRIPTION

The UNIMETRICS Digi Scan-16 is a compact, fully transistorized, dual conversion FM receiver capable of automatically scanning up to 16 crystal-controlled channels in either the 30 thru 50 MHz, 150 thru 174 MHz, 450 thru 470 MHz bands. In the automatic scanning system, the receiver will continuously scan each channel until a signal is received. Upon the cessation of the transmission automatic scanning will resume until another transmission is received on one of the channels. An instant reading, digital read-out indicator shows the channels being selected at all times. Individual "lock-out" switches for each channel permit skipping of channels you do not wish to monitor.

This receiver can receive the UHF band from Ch. 1 – Ch. 8, and receive the VHF low and high bands through Ch. 9 – Ch. 16.

The low and high bands can be automatically changed by inserting the desired crystal in Ch. 9 – Ch. 16.

Designed and built for reliable, trouble-free performance, the receiver uses rugged heat-resistant transistors in all critical areas. Silicon transistors are used in the receiver oscillator, RF stages, IF stages, audio circuits and automatic scanning circuits. Current drain on 13.8 volts DC is exceptionally low, permitting continuous monitoring in mobile operation for a long period of time, even with automobile's motor switched off.

The receiver is designed to operate from 11.5 to 14.5 volts DC (negative ground), but may also be operated from AC 115 to 120 volts, 60 Hz. The receiver will provide reliable radio reception in its intended application if installed and operated in accordance with instructions contained herein.

IMPORTANT

RECEPTION OF A POLICE FREQUENCY BY UNAUTHORIZED PERSONNEL IS ILLEGAL IN SOME AREAS. It is the responsibility of the person making the installation to be sure that the user of this receiver is authorized or cleared through the local police department. Under no conditions can Unimetrics, Inc., manufacturer of this receiver be held responsible for its unauthorized installation or use.

SEMI-CONDUCTOR COMPLEMENT

10.7 MHz I.F. Amplifier	TR1	2SC829/2SC1032
2nd Mixer	TR2	2SC829/2SC1032
455 KHz Limiter	TR3	2SC829/2SC1032
Voltage Regulator	TR4	2SC1226A
Voltage Regulator	TR5	2SC828/2SC711
Voltage Regulator	TR6	2SC829/2SC1032
Second Conversion Oscillator	TR7	2SC829/2SC1032
Audio Amplifier	TR8, 9	2SC829/2SC1032
Audio Driver	TR10	2SC829/2SC711
Squelch Noise Amplifier	TR11	2SC829/2SC1032
Squelch Switching	TR12, 13	2SC829/2SC1032
Audio Output Amplifier	TR14, 15	2SC1226A

AUTO-SCAN Switching	TR16	2SC829/2SC1032
Multivibrator	TR17, 18	2SC829/2SC1032
Flip-Flop	TR19 thru TR26	2SC828/2SC711
Crystal Gate	TR27 thru TR42	2SC828/2SC711
Master Switch for Channel 1 thru 16	TR43, 44	2SC828/2SC711
Bands Indicator Switch	TR45, 46	2SC828/2SC711
Channel Indicator Switching	TR47 thru TR52	2SC829/2SC1032
Channel Indicator Switching	TR53 thru TR59	2SC828/2SC711
VHF High Band RF Amplifier	TR401	2SC1047/2SC722
VHF High Band 1st Mixer	TR402	2SC1047/2SC722
VHF Low Band RF Amplifier	TR403	2SC1047/2SC722
VHF Low Band 1st Mixer	TR404	2SC1047/2SC722
VHF Local Oscillator	TR405	2SC1047/2SC722
UHF Band RF Amplifier	TR501	2SC683
UHF Band Tripler	TR502	2SC683
UHF Band 1st I.F. Amplifier	TR503	2SC722/2SC1047
UHF Band 2nd Mixer	TR504	2SC722/2SC1047
UHF Band Tripler	TR505	2SC722/2SC1047
UHF Band Local Oscillator	TR506	2SC722/2SC1047
455 KHz I.F. Amplifier	I.C.-1	LA-1201
Ratio Detector	D1, 2	1S34
Power Rectifier	D3, 4, 5, 6	FR-2
Varistor	VS-1, 2	1S1209
Logic Circuit Diode	D7 thru D38	1S1588
Logic Circuit Diode (Indicator)	D39 thru D54	1S1588
Germanium Diode	D401, 402	1N60
UHF Mixer	D501	SD82A

OPERATION THEORY OF DIGI SCAN-16

Digi Scan-16 newly developed by UNIMETRICS is 3-band super-heterodyne receiver which has two kinds of Front End.

One band is called "Band A" which refers to Ch. 1 thru Ch. 8 and other band is called "Band B" which refers to Ch. 9 thru Ch. 16.

Band A is designed for UHF use, and Band B for VHF use. In addition, the VHF band can be used freely as a VHF low or high band by only changing the crystal. Therefore, this receiver can be very convenient in that it can pick up any of the three bands.

VHF LOW BAND:

As to Front End operation, circuitry consisting of single RF stage superheterodyne is employed to obtain high sensitivity.

Signals caught and induced in antenna are amplified through coils T-406, T-407, T-408 and RF amplifier TR-403. T-406, T-407, and T-408 are the coils to determine bandwidth of the receiver and designed to obtain bandwidth of 5 MHz/−6 db. This RF circuitry works to suppress spurious radiation from RF oscillator which causes interferences to other receivers.

The purpose of diode D-402 is to eliminate RF signal distortion and spurious due to too strong incoming signal and to smoothly amplify both weak signal in fringe and strong signal in local area.

TR-404 is 1st mixer to heterodyne the incoming signal and convert it to 10.7 MHz IF signal.

TR-405 is local oscillator, the frequency of which is controlled by a crystal maintaining the frequency error within 1/100,000 so that the signal can be received reliably without interferences from adjacent stations.

10.7 MHz IF signal is amplified through T-1, T-2, TR-1, and T-3, at the same time the circuit sharpens up selectivity through concentrated filter system T-405, T-1 and T-2.

TR-2 is 2nd mixer. 455 KHz IF signal is heterodyne-detected by mixing 10.245 MHz from TR-7 and 10.7 MHz from TR-1 through T-3. This 455 KHz IF signal selectivity is sharpened thru T-4, T-5 and band-pass filter (B.P.F.) up to so much as ± 8 KHz/−6 db, ± 30 KHz/−60 db, then the signal is supplied to IC-1. (T-4 and T-5 act as matching transformer for the B.P.F., eliminating B.P.F. insertion loss and ripple).

IC-1 contains 3 stage-amplifiers having 70 db amplification gain. As mentioned above, highly amplified IF signal is supplied to limiter TR-3 and the limiter enters into action at the input signal level lower than $1 \mu\text{V}$, so the signal noise is suppressed even if incoming signal is very low.

Circuits consisting of T-8, T-9, D-1, D-2 is ratio detector, and its linear portion (peak separation) of S curve measures ± 50 KHz at incoming signal level lower than $1 \mu\text{V}$, therefore, the receiver performs excellent without distortion.

TR-8 and TR-9 work as audio amplifiers, and as for TR-9 operation, collector voltage of TR-9 is controlled by control signal from squelch circuits (T-13 noise signal take-off coil, TR-11 noise amplifier, TR-12 noise detector, TR-13 switching transistor). Noises are completely cut off as the squelch gets into operation.

TR-10, TR-14 and TR-15 are audio power amplifier to OTL system, employing input transformer (T-12). Besides, varistor VS-1 and VS-2 are employed for temperature compensation considering the receiver to be used under any temperature condition.

On the other hand, output signal from TR-8 is supplied to TR-11 through squelch control RV-4, and this noise amplifier circuits (TR-11) for squelch amplifies noise frequency 30 KHz ± 10 KHz, then amplified noise output is detected by TR-12 controlling TR-13's operation to cut its operation off.

For example, when incoming signal contains much noise component, noise component thru bandpass filter T-13 increases and also is amplified by TR-11. Therefore, TR-11 noise output voltage makes TR-12 conductive, having TR-13 cut off due to nearly zero potential of TR-13 base, and TR-13 internal resistance becomes extremely high, which means TR-9 collector voltage drops a lot.

Accordingly, audio circuits operation comes to complete stop. Thus, squelch system works.

In reverse order, we can trace the case that incoming signal contains no noise. When no noise comes to TR-13 through TR-11 and TR-12, naturally TR-12 is cut off and TR-13 becomes completely conductive, therefore, normal collector voltage is supplied to TR-9 collector to operate audio circuits normally.

TR-17 and TR-18 are unstable multi-vibrator system generating basic control signal for scanning circuits. Four Flip-flop circuits of TR-19 thru TR-26 are controlled by this signal from the multi-vibrator.

The signal from those 4 flip-flop circuits properly controls diode logic system, then channel indicator switching circuits, crystal gate circuits and also scanning circuits.

* For instance, provided that channel 1 signal is received now, TR-13 in squelch circuits becomes conductive due to less noise contained in the signal. TR-16 becomes conductive with its positive base potential voltage, and consequently, TR-17 base potential in multi-vibrator is grounded, so the multi-vibrator stops. Due to the operation stop of the multi-vibrator, 4 systems of flip-flop block stop the operation, maintaining the voltage conditions as they stopped the operation.

Logic circuits are operated under this condition. Digit 1 on indicator is illuminated due to operation of crystal 1 and A and E in indicator circuits (see schematic diagram).

POWER SUPPLY CIRCUITS:

The receiver has been designed to operate with AC 117 V, 50/60 Hz and DC 13.8 V. TR-4, TR-5 and TR-6 form stabilizing circuits, with its control signal (3 V) coming from IC-1 control voltage, therefore, the stabilizer maintains excellent stability under any receiving condition.

Especially rectifying circuits comprising D-5 and D-6 have been designed exclusively for channel indicator, Scan-Manual and Band indicator lamps, so +B line voltage gets no affect from those lamp's ON - OFF keeping stabilized voltage.

VHF HIGH BAND:

As to Front End operation, circuitry consisting of RF single stage superheterodyne is employed to obtain high sensitivity.

Signals caught and induced in the antenna are amplified through coils T-401, T-402, T-403, T-404 and RF amplifier TR-401. T-401, T-402, T-403 and T-404 are the coils to determine bandwidth of the receiver and designed to obtain 7 MHz/-6 db bandwidth. This RF circuitry works to suppress spurious radiation from RF local oscillator which causes interferences to other receivers.

The purpose of diode D-401 is to eliminate RF signal distortion and spurious due to too strong incoming signal and to smoothly amplify both weak signal in fringe and strong signal in local area.

TR-402 is 1st mixer to heterodyne the incoming signal and convert it to 10.7 MHz IF signal.

TR-405 is local oscillator, the frequency of which is controlled by a crystal maintaining the frequency error within 1/100,000 so that the signal can be received reliably without interferences from adjacent stations.

T-409 is tripler to obtain 3 times overtone from original oscillator frequency.

* For instance, when receiving 155 MHz signal, $(155 - 10.7)/3 = 48.100$ MHz signal is generated in its local oscillator and furthermore the 48.100 MHz is tripled by T-409 to be 144.3 MHz for mixer injection.

10.7 MHz IF signal is obtained from the mixer by mixing the tripled signal 144.3 MHz and the received signal 155 MHz, $(155 \text{ MHz} - 144.3 \text{ MHz}) = 10.7 \text{ MHz}$.

UHF BAND:

As to UHF Front End operation, circuitry consisting of single RF stage double superheterodyne is employed to obtain excellent sensitivity and selectivity.

Signals caught and induced in antenna are amplified through coils L-501, L-502, L-503, and RF amplifier TR-501. L-501, L-502 and L-503 are the coils to determine bandwidth of the receiver and designed to obtain 7 MHz bandwidth at minus 3 db. This RF circuitry works to suppress spurious radiation from RF local oscillator which causes interferences to other receivers.

On the other hand, TR-506 is local oscillator to attain crystal-oscillated local signal. The signal from the local oscillator is tripled by T-505 and TR-505, and furthermore tripled frequency signal is tripled again by tripler consisting of TR-502 and L-505 (9 times of original local frequency).

Frequency signal made up through above procedures is injected to mixer diode D-501 to produce 1st IF signal (54.63 to 56.63 MHz). 1st IF signal obtained like this is injected again to 1st mixer TR-504 after amplifying at TR-503.

Original local frequency generated by TR-506 is injected to trap coil T-507 of TR-504, and mixed with 1st IF signal. 1st IF signal 10.7 MHz is finally obtained from TR-504.

*For instance, when receiving 463 MHz signal, the UHF local oscillator generates $(463 - 10.7 \text{ MHz})/10 = 45.23 \text{ MHz}$.

This fundamental frequency 45.23 MHz is two times tripled by TR-505 and TR-502 (9 times of fundamental) to attain 407.07 MHz, then both incoming signal 463 MHz and the 407.07 MHz are heterodyned by D-501 to produce 1st IF signal $(463 - 407.07 \text{ MHz}) = 55.93 \text{ MHz}$.

Further at 1st mixer stage (TR-504), 1st IF signal $(55.93 - 45.23 \text{ MHz}) = 10.7 \text{ MHz}$ is produced and supplied to next 10.7 MHz IF stages.

OPERATION CONTROLS AND FEATURES

- | | |
|--------------------------------|---|
| [1] MOUNTING BRACKET | Specially designed bracket simplifies mobile installation under the dash --- has "quick-release" feature for fast removal of receiver. |
| [2] SQUELCH | This control is used to "quiet" the receiver during "no-signal" conditions. Degree of sensitivity to incoming signals is adjustable. Full clockwise provides maximum squelch. |
| [3] CHANNEL INDICATOR | Instant-reading, digital read-out indicator shows crystal position selected (one thru eight). |
| [4] MANUAL-SELECT SWITCH | This switch used to manually select channels. |
| [5] VOLUME | Varies the audio output to the speaker. |
| [6] POWER SWITCH | Push-button switch turns the power ON or OFF. No waiting time is necessary for warm-up. |
| [7] SCAN-MANUAL SWITCH | Selects mode of operation for the receiver --- either automatic scanning or manual selection of channels. |

- [8] BAND INDICATOR ----- The number of channels in this receiver is 16, but the digital channel indicator shows only No. 1–8 channels. For No. 1–8 channels, therefore, the band indicator shows “UHF”; for No. 9–16 channels, too, the digital indicator shows No. 1–8 channels, but the band indicator shows “VHF” in order to distinguish these channels from the UHF ones.
- [9] RATE CONTROL ----- This control is used in order to change scanning speed of auto-scan, and possible to control the speed continuously.
- [10] SPEAKER ----- P.D. Type 4" $\times$ 2- $\frac{3}{4}$ " oval speaker, 8 Ohms.
- [11] AC/DC POWER RECEPTACLE ----- AC : Connect AC power cord attached as an accessory to AC receptacle.
Usable power source is AC 117 V, 60 Hz.
DC : Using DC power cord attached as an accessory, connect RED LEAD to positive side, and BLACK LEAD to negative side.
Usable power source is DC 13.8 V (when used in vehicle etc., ground negative connection is necessary).
- [12] EXT. SPEAKER—PHONES ----- Allows use of Headphone for private listening or 8 ohms external speaker automatically silence.
- [13] ANTENNA ----- A : This connector is used for connection to the antenna which using in Ch. 1 thru Ch. 8.
B : This connector is used for connection to the antenna which using in Ch. 9 thru Ch. 16.
- [14] ANTENNA SWITCH ----- This switch is used for connection or disconnection antenna B to antenna A. When used the antenna which is able to cover two kinds of band-width of different frequency such as VHF and UHF Band.
Turn this switch on, and you can receive both bands with one antenna, since antenna A and antenna B will be connected each other.
- [IMPORTANT] 1) When only one antenna Lead-in is to be used for both bands, Antenna Selector switch should be in the “ON” position. Connect single antenna lead-in to SO-259 jack “A”.
2) When two separate antenna Lead-ins are to be used, Antenna Selector switch should be in the “OFF” position. Connect each antenna lead-in to SO-259 jack “A” and “B”
- [15] CHANNEL LOCKOUT SWITCHES ---- Individual switches for each crystal position permit skipping of any channel (when set to off) during auto-scanning or manual modes of operation.
- [16] CRYSTAL SOCKETS ----- These are located behind plate for insertion of up to 16 receiving crystals. Each crystal provides one channel of operation.

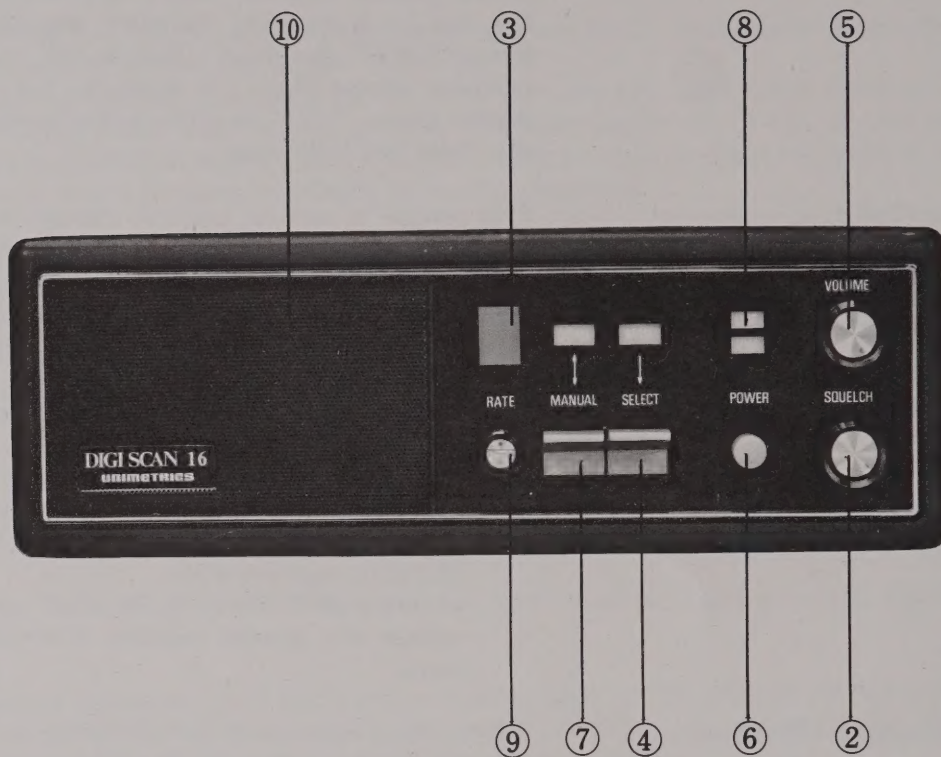


FIGURE 1

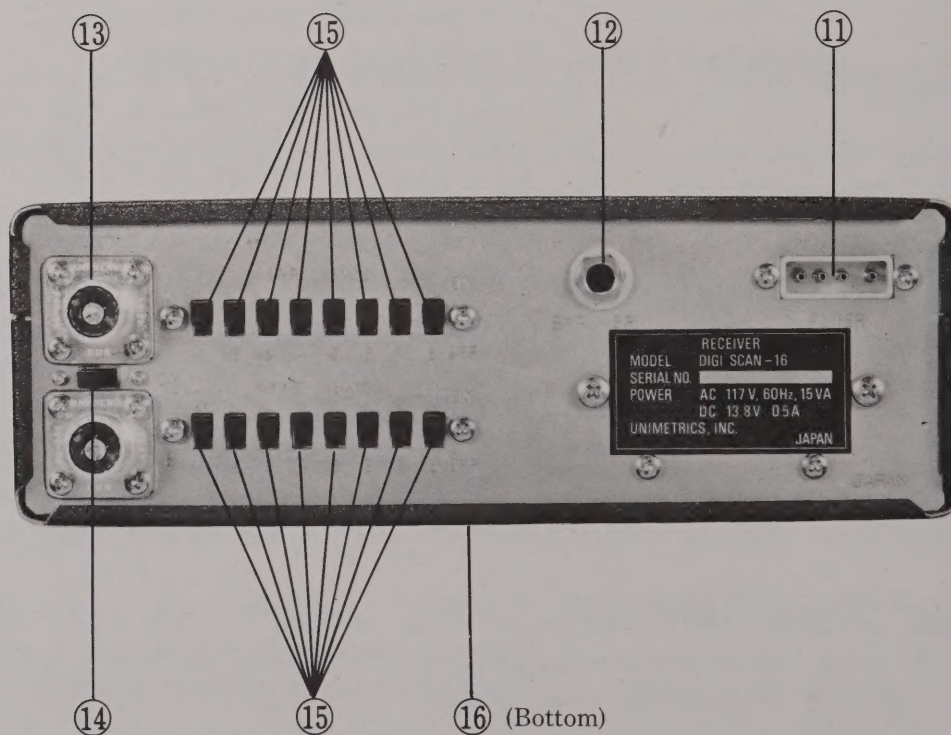


FIGURE 2

MOBILE INSTALLATION

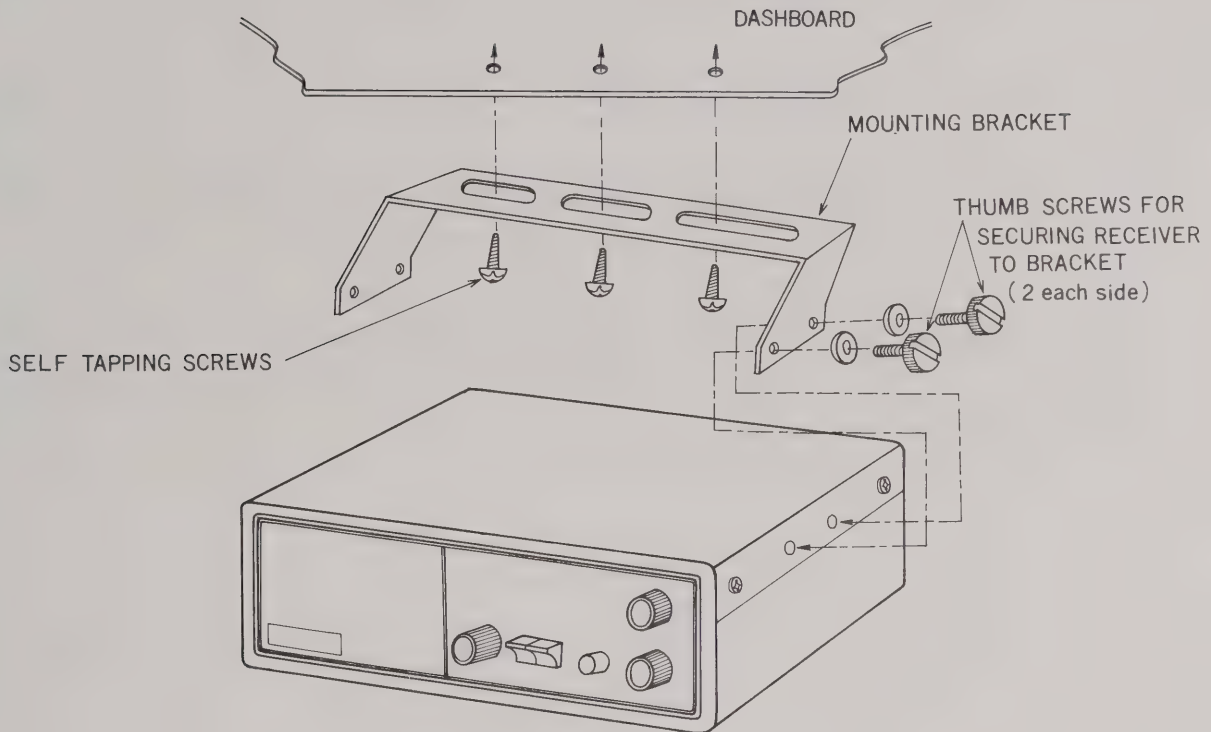


FIGURE 3 MOBILE INSTALLATION

RECEIVER MOUNTING

Before installing the receiver in a car, truck, boat, etc., be sure to choose a location which is convenient to the operator, and will not interfere with the normal functions of the driver. The set may be mounted to the underside of dashboard of a car, truck, etc., by means of the bracket supplied with the unit. Attach this bracket to the underside of the dash or instrument panel using three self-tapping screws (See Fig. 3). Secure the unit to the bracket by means of four large knurled thumbscrews, as shown.

ANTENNA CABLE CONNECTION

The antenna should be connected to the receiver by means of coaxial cable. Either RG-58/U or RG-8/U coaxial cable is ideal for this purpose.

The antenna lead-in cable should be terminated with a PL-259 type male coaxial connector which should then be attached to the matching ANT. connector at the rear of the receiver.

ANTENNA A: The antenna for Ch. 1 through Ch. 8 should be connected to this connector.

ANTENNA B: The antenna for Ch. 9 through Ch.16 should be connected to this connector.

As for the slide switch of the antenna, please refer item OPERATION CONTROLS AND FEATURES.

ATTACHING THE DC POWER CORD TO THE RECEIVER

The plug at the end of the DC power cord is attached to the power socket at the rear of the receiver (See Fig. 4-A); notice that the pins are unequally spaced allowing the plug to be inserted only in one direction.

DC POWER CONNECTIONS

NOTE ----- The unit will operate from a battery source of 11.5 to 14.5 V DC, on negative ground systems only. Connecting the unit to a positive ground vehicle will severely damage the receiver.

Connect the fused power lead (RED) of the DC power cable to the positive or HOT side of the electrical system. Points normally available for this purpose are the accessory post on the ignition switch, the voltage regulator side of the ammeter or the accessory side of the fuse block. The other lead (BLACK) should be connected to the metal firewall or any other point that is connected to the vehicle chassis. Keep these leads as short as possible. (See Fig. 4-A)

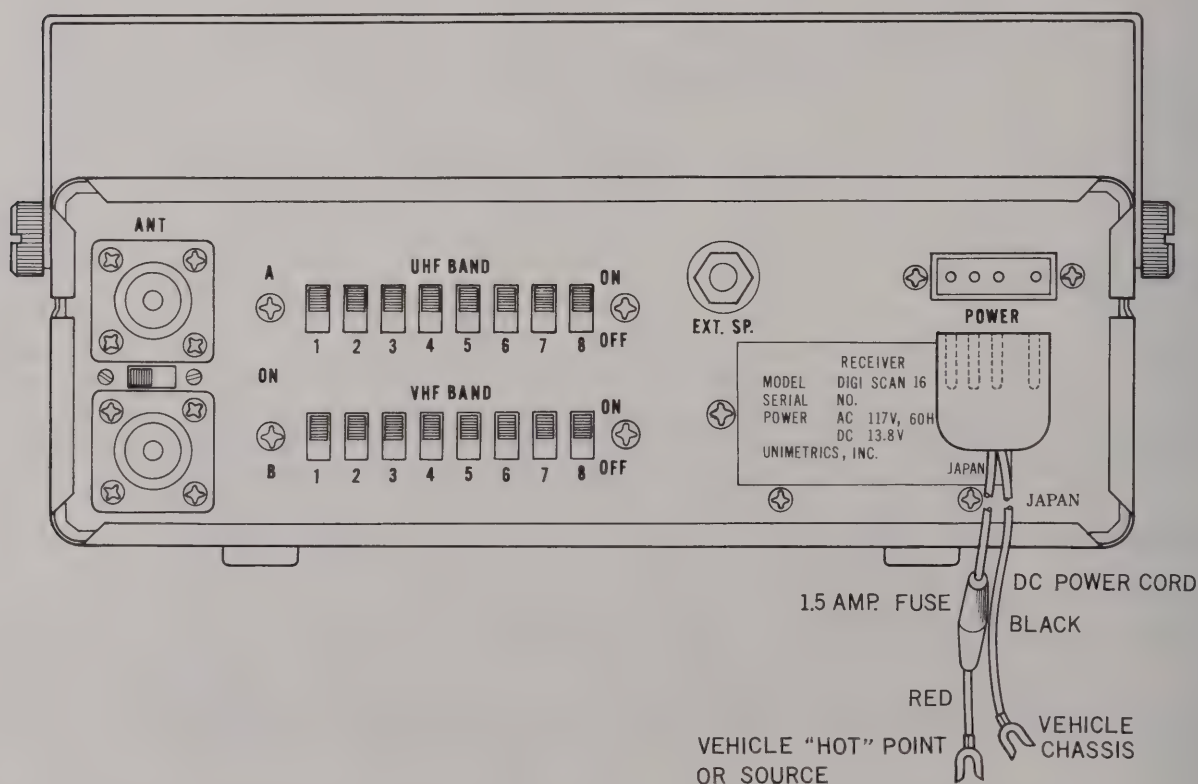


FIGURE 4-A

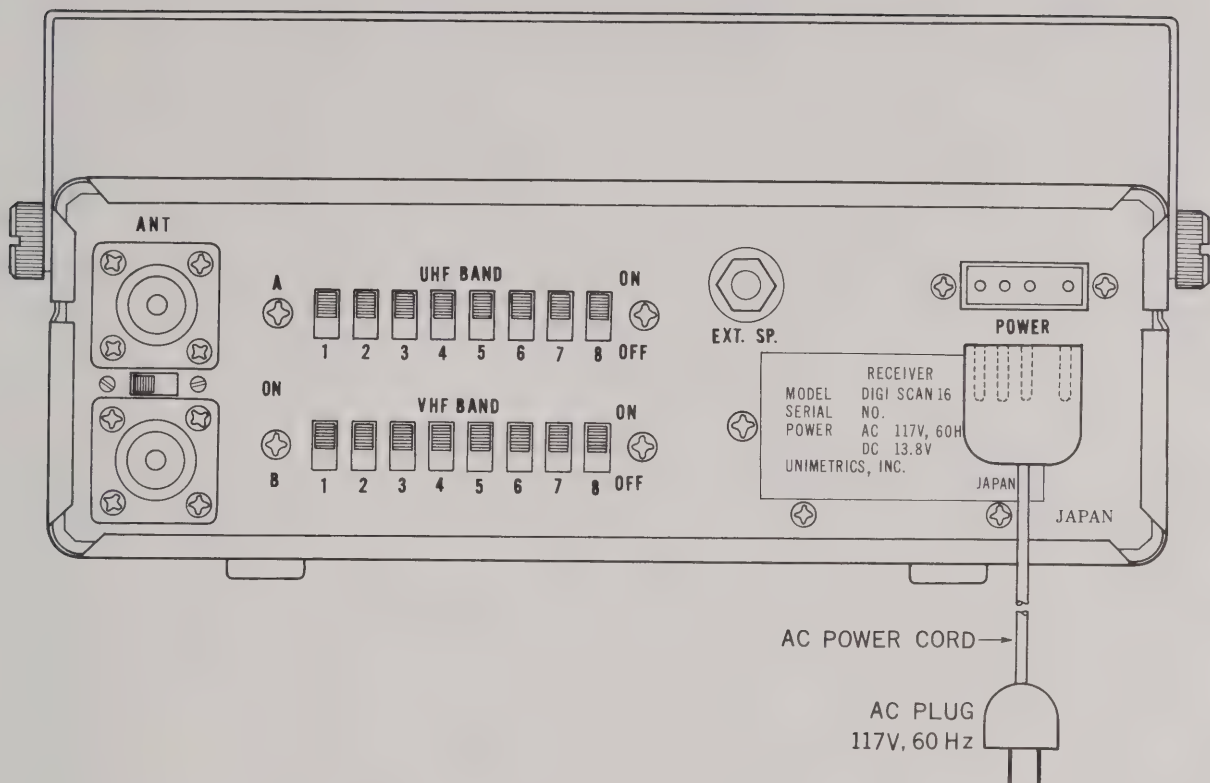


FIGURE 4-B

IGNITION INTERFERENCES

AUTO : Reception of FM signals is usually not affected by automobile ignition noises, and therefore should not be a problem in most cases. However, sufficient noise may be generated by some vehicles to make it necessary to install additional suppression.

Ignition radiation suppression requires the use of resistor spark plugs, feed-thru capacitors and distributor suppressors. Of prime importance is a properly adjusted ignition system. The following steps will serve as a guide.

- 1) **SPARK PLUGS** -- Install resistor spark plugs or Belden IRS cable.
- 2) **DISTRIBUTOR CAP** -- Install suppressor resistor IRS cable between distributor cap and ignition coil.
- 3) **GENERATOR** -- Install 0.5 mfd. coaxial capacitor (Sprague #48P18 or equivalent) at the "A" terminal of generator.
- 4) **ALTERNATORS** -- Require no attention except when the diodes become defective or when the slip-rings are dirty.
- 5) **IGNITION COIL PRIMARY** -- Install 0.1 mfd coaxial capacitor (Sprague #48P9 or equivalent) in the lead from ignition switch to coil. Keep capacitor close to coil terminal. Brighten the metal around the coil mounting bracket to engine block, apply grease and retighten mounting screws.

- 6) **REGULATOR FIELD TERMINAL**--Connect a 39 ohm resistor in series with 0.01 mfd ceramic capacitor between the field terminal and ground.
ARMATURE TERMINAL--Insert 0.2 mfd coaxial capacitor (Sprague #48P18 or equivalent).
- 7) **GAUGES**--Install 0.5 mfd, 200 volt capacitors from terminals to ground.
- 8) **WHEELS AND TIRES**--Inject special graphite powder (available at automotive parts supplier) into the tires.

ANTENNAS

The receiving capabilities with your new Unimetrics Digi Scan-16 will be greatly determined by efficiency of the antenna system used. Due to the complexity of the subject, it is not within the scope of this manual to provide detailed information on antenna systems, although this section does contain some general information which may be of value.

RG58/U or RG8/U should be used as the antenna lead-in cable. For optimum results in a mobile installation, the length of antenna cable should be made as short as possible.

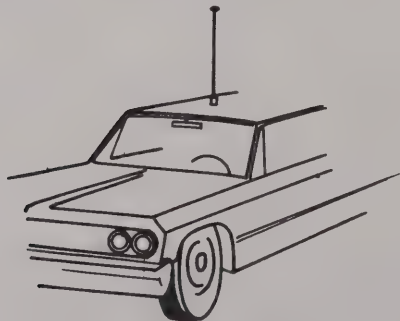
In a base station installation, an exceptionally long lead-in cable may be required. When lengths of over 50 feet are necessary, RG8/U coaxial cable is more suitable since it offers lower loss than RG58/U.

The antenna lead-in cable (RG58/U or RG8/U) should be terminated with a PL-259 type male coaxial connector which should then be attached to the matching SO-239 connector at the rear of the receiver.

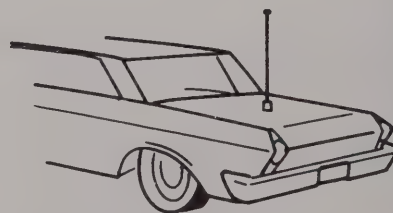
MOBILE ANTENNAS

The type of antenna best suited for mobile service is a vertically polarized non-directional whip antenna. This type uses the metal body of the vehicle as a ground plane effect for the antenna. There are number of locations that may be used for the installation of antenna. Two of the most popular locations are those illustrated below.

For best results, the vertical whip antenna should be mounted on the roof-top of the vehicle. Mounting the antenna on the trunk-lid of the vehicle is a method that is also used but somewhat less efficient than the roof-top mounting.



ROOF MOUNTING



REAR DECK MOUNTING

MARINE ANTENNA AND INSTALLATION

The antenna system for a boat requires a ground plane antenna. The common name for such an antenna is "coaxial ground plane antenna." The boat ground system which usually consists of a ground plate is not efficient in VHF or UHF and therefore, should not be relied upon for use with a simple whip antenna. This does not apply where the boat is of all-metal construction.

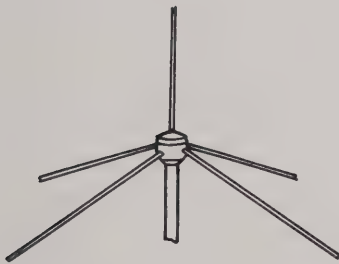
The same bonding and ignition suppression techniques must be applied to a boat as to an automobile. In many cases a boat requires more work because the engine compartment is of wood construction whereas an automobile has a metal hood and firewall to shield the engine. A boat's wooden engine compartment requires copper mesh shielding that is adequately connected to a bonded electrical system.

Bonding a boat requires that electrical and metal fittings be interconnected together and then connected to the engines. The propeller shaft can be bonded to the engine with the use of a spring steel wiper resting on a cleaned portion of the shaft. The wiper and all other fittings can be bonded to the engine using 2 inch wide copper strips.

The engine should then be connected to a hull bottom ground plate or ground tube, again using the same copper strip.

BASE STATION ANTENNAS

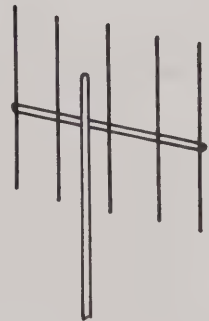
There are three basic types of antenna that are used for the reception of high frequency FM signals. These antennas are shown below.



GROUND PLANE



COAXIAL ANTENNA



VERTICAL BEAM

1. VERTICAL GROUND PLANE ANTENNA.

The vertical ground plane antenna is an omnidirectional type antenna that provides optimum performance for reception of signal that are vertically polarized. Most stations transmitting on the "high" band of frequencies (frequencies covered by your receiver) use antennas that are also vertically polarized, making this type of antenna adequate for reception of signals from medium to long range distance.

2. COAXIAL ANTENNA.

The coaxial type antenna is an antenna similar in operation to the ground plane antenna. This type of antenna performs as well in most application as that of the ground plane type. The coaxial antenna is ideal for those installations where a vertical ground plane is not feasible. This antenna, as in the

case of the ground plane, is good for reception of signals from medium to long range distance.

3. VERTICAL BEAM ANTENNA.

The vertical beam antenna is a highly efficient and directional antenna generally intended for long range reception of signals. An average five elements vertical beam provides an equivalent of 8 db increase in signal reception.

BASE STATION INSTALLATION

The receiver has built-in AC power supply facilities, and only requires the use of the AC power cord (supplied) for operation from 115~120 volts, 60 Hz AC (house current). To operate on AC, insert the female plug end of the AC cord into the matching power socket on the rear of the receiver, and then insert the AC plug at the other end into an AC outlet. See Figure 4-B.

The antenna lead-in cable should be terminated with a PL-259 type male connector and attached to the matching ANT. connector at the rear of the receiver. For general information on antenna cables and antennas, see the section headed ANTENNAS.

CRYSTAL INSTALLATION

NOTE: Due to the numerous frequencies (channels) involved and the accuracy required(.001% Tol.), it is recommended that the proper crystal for the desired channel frequency be purchased directly from Unimetrics, Inc. The crystal is not normally installed by the factory, but by the seller or owner of the unit. Crystals are available on special order only. When ordering crystals, specify desired receiving frequency.

PLEASE READ THE FOLLOWING BEFORE ORDERING CRYSTALS

Each Digi Scan -16 is normally available from the factory tuned to the following standard center frequency.

- [1] Low Band Receivers (30-50MHz): Standard Center Frequency 35MHz
- [2] High Band Receivers (150-174MHz): Standard Center Frequency 155MHz
- [3] UHF Receivers (450-470MHz): Standard Center Frequency 463MHz

These are center frequencies, of course. The circuits are so designed as to permit operation of up to 8 channels over a band of frequencies without retuning, as follows:

- | | | |
|--|---|---|
| [1] Low Band : | ※ | |
| 33 – 37 MHz ($35 \pm 2.0\text{MHz}$), Total spread 4MHz. | | 33.0 35.0 37.0
└──────────┴──────────┴──────────┘ |
| [2] High Band : | ※ | |
| 151.5 – 158.5MHz ($155 \pm 3.5\text{MHz}$), Total spread 7MHz. | | 151.5 155.0 158.5
└──────────┴──────────┴──────────┘ |
| [3] UHF Band : | ※ | |
| 459.5 – 466.5 ($463 \pm 3.5\text{MHz}$), Total spread 7MHz. | | 459.5 463.0 466.5
└──────────┴──────────┴──────────┘ |

※ Center frequency.

When ordering additional crystals for a receiver tuned to a standard center frequency, make sure the monitoring frequencies requested fall within the specific spread indicated above. If the monitoring fre-

quencies requested with the original order of the receiver fall outside of the frequency spread provided by a standard center frequency, the receiver must be retuned to a new center frequency before being shipped to accommodate the requested monitoring frequency[s]. When ordering additional crystals for such a receiver, be sure the requested monitoring frequencies fall within the total spread provided by the new center frequency.

INSERTING CRYSTALS

Remove crystal compartment cover at the bottom of the receiver by removing the 2 Phillips head screws. Refer to Figure 5 and insert the crystals desired. For convenience, a record should be kept of the monitoring frequencies and the channels in which they appear.

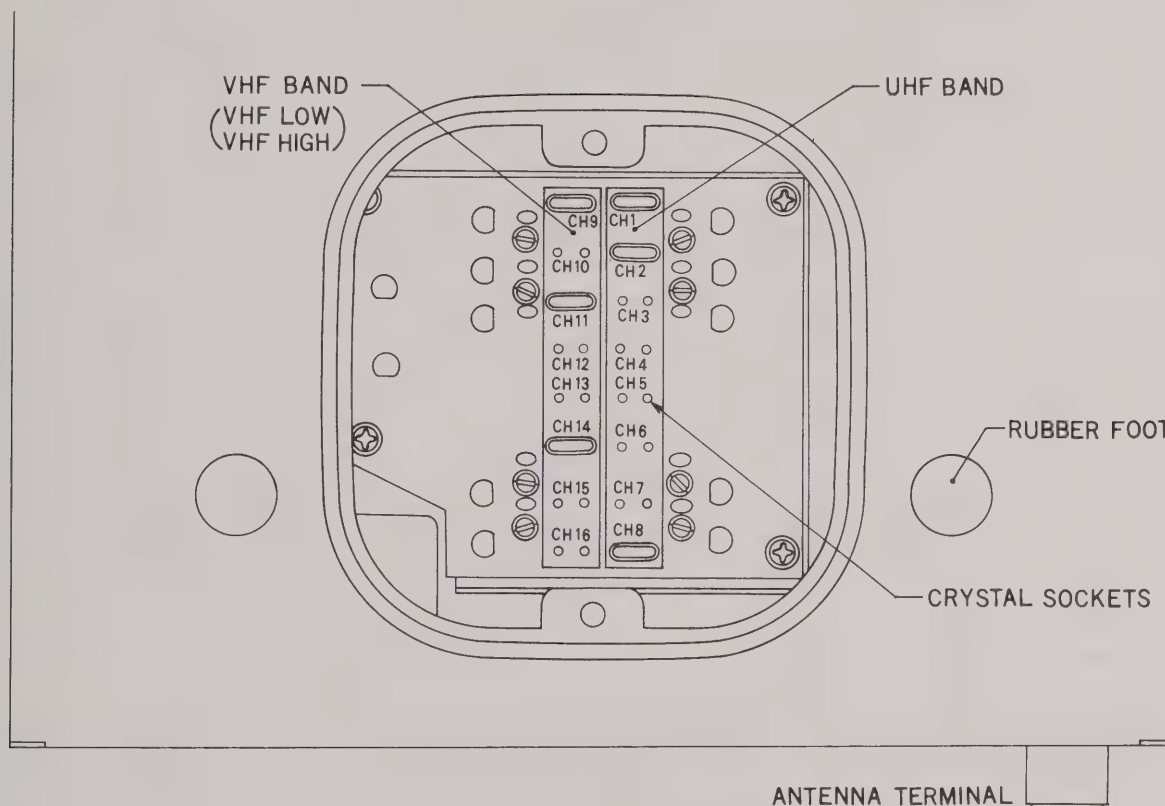


FIGURE 5 CRYSTAL INSERTION

CRYSTAL FREQUENCY DETERMINATION AND CORRELATION

Crystals used in DIGI SCAN-16 are type HC-25/U.
Crystal frequencies are normally determined as follows.

FREQUENCY FOR LOW BAND VHF 30–50 MHz:

Crystal 3rd overtone frequency = Channel frequency $F + 10.7$ MHz

FREQUENCY FOR HIGH BAND VHF 150 – 174 MHz:

Crystal 3rd overtone frequency = Channel frequency $\frac{F - 10.7 \text{ MHz}}{3}$

FREQUENCY FOR UHF BAND 450 – 470 MHz:

$$\text{Crystal 3rd overtone frequency} = \text{Channel frequency } \frac{F - 10.7 \text{ MHz}}{10}$$

Frequency deviation is less than 2/100,000 in low VHF band 30–50 MHz and high VHF band 150–174 MHz.

Frequency deviation is less than 1/100,000 in UHF band 450–470 MHz.

CRYSTAL CORRELATION:

Resonance -----	Parallel
Overtone -----	3rd
Load Capacity -----	32 pF ※
Max. Series Resistance -----	Less than 40 ohms
Frequency Tolerance -----	±.001 % (at 25 °C)

※ This particular number could vary depending upon crystal manufacturer, but crystal trimmer will take care of any error.

For convenience, a record should be kept of the frequencies as they are added, and the positions in which they have been inserted.

OPERATING INSTRUCTIONS

Make sure the receiver is properly installed for base or mobile installations as described previously, and that the antenna and power source are connected properly. At least one crystal must be inserted into the crystal sockets in the receiver (See Fig. 5). Rotate squelch control to the extreme counter-clockwise position, press the power button to switch on. Rotate the volume control knob clockwise to about $\frac{1}{3}$ setting.

Initially, place all “lock-out” switches at the rear to the ON position. The number of channels in this receiver is 16. But only the channels from No. 1 to 8 are shown by the digital channel indicator; those from No. 9 to 16 cannot be shown. So for channels from No. 1 to 8, the band indicator shows “UHF,” and for those from No. 9 to 16, it shows “VHF,” although the digital indicator shows channels No. 1 to 8 in both cases.

MANUAL OPERATION

The receiver may be operated in the manual mode to select and hold on any channel. Press the SCAN-MANUAL lever down to the MANUAL position, then press down the spring-loaded MANUAL-SELECT lever momentarily. This will cause the next channel in sequence to be selected, as indicated by the digital indicator. Repeat until desired channel is indicated. Note that all channels are selected, even those for which no crystals have been inserted and are therefore inactive. The receiver will hold onto any selected channel until manually changed.

AUTO SCANNING OPERATION

Place the SCAN-MANUAL lever in the SCAN position. The receiver will automatically commence scanning all 8 channels in sequence, the digital indicator showing the channels selected during this process. The first channel on which a carrier is received will cause the receiver to stop scanning and lock onto the channel. When the communication ceases and the carrier is no longer present, the receiver will resume scanning again, until the next carrier is received on a channel. Note that all channels are scanned, even those for which no crystals have been inserted and are therefore inactive.

RATE CONTROL OPERATION

This knob is designed for controlling scan speed when at auto-scanning. So, adjust it so as to get optional speed.

Furthermore, receiving channel will be shifted into other one in reception as too much speedy, so suggested to use speed control at near its center.

CHANNEL LOCKOUT SWITCHES

Initially, all channel “lock-out” switches at the rear of the receiver should be placed in the “ON” position. Activated channels (channels for which crystals have been inserted) may be “skipped” by placing the appropriate switch in the “off” position. In this manner, a channel (or channels) which you do not wish to monitor during automatic scanning (such as the U.S. Weather Bureau Signals) can be bypassed.

SQUELCH ADJUSTMENT

To adjust the Squelch Control properly during reception, turn Volume up until back ground noise is heard (No signal should be present in this case). Rotate the squelch slowly clockwise until the back ground noise just disappears. At this point, the receiver will be quiet under no-signal conditions, but an incoming signal will overcome the squelch action and be heard.

Since this control is variable it can be used to provide varying degrees of sensitivity to incoming signals.

As the control is advanced to clockwise position, the squelch action is progressively increased and a stronger incoming signal is needed to overcome it.

To receive extremely weak signals or to disable the squelch circuit, simply turn the control fully counterclockwise.

In areas of high noise, you may have to slightly increase the setting of the Squelch Control in order to achieve a quiet condition. However under these condition an extremely weak signal may not be overcome the squelch action and will not be heard. If severe noise is generated by your own vehicle, proper ignition suppression should be carried out.

EARPHONE/SPEAKER JACK

The recommended plug for the earphone jack is a Tini-Plug, sub-miniature phone plug, available from Unimetrics, Inc. The impedance of earphone or speakers connected to this jack should be 4-8 ohms. Insertion of a plug into the jack automatically silences the internal speaker.

REPLACEMENT OF RF MODULES

This receiver is designed so as to be able to replace Front End as RF Modules.

Procedures for installation of RF Module are as follows: (Refer to Fig. 6)

1. Remove the cover of the receiver by removing each three screws on the top and bottom sides.
2. Remove leads of RF Modules (Six pcs. for one Module).
3. Remove four fixing screws for tuner mounting brackets.
Tuner mounting brackets can be stood in vertical ward against rear panel by removing these screws.
4. Remove four nuts and fixing screws of RF Module. RF Module is now changeable by doing it.
5. Install RF Modules to be fixed in accordance with the procedure inversely that is, from step (4) to Step (1).

Remarks: Be careful to fix them in correct directions for each RF Modules.

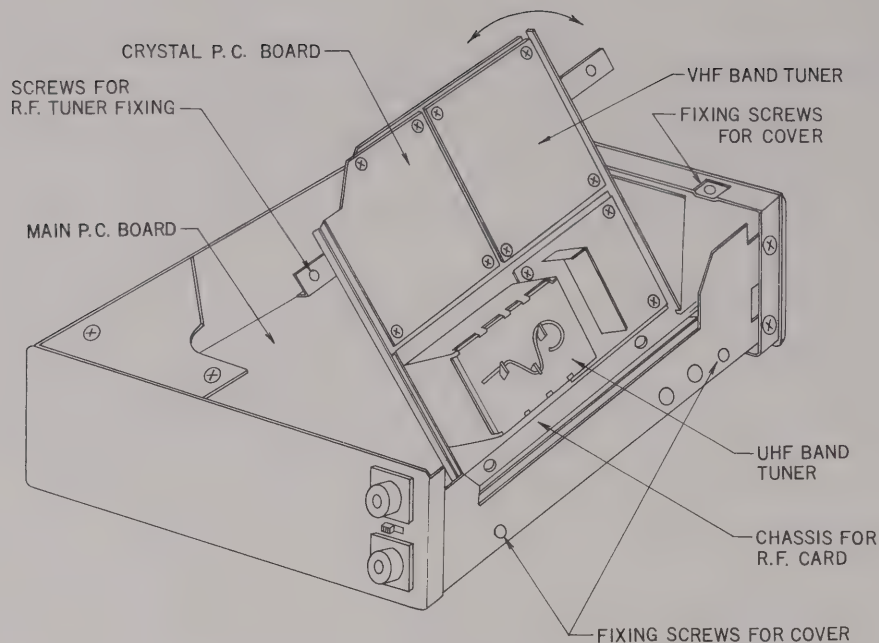


FIGURE 6 REPLACEMENT OF RF MODULES

AC FUSE LOCATION

The AC fuse is located within the receiver. Access to the fuse is obtained by removing the bottom cover (See interior layout view for actual location).

ALIGNMENT INSTRUCTION

ALIGNMENT OF STABILIZED POWER VOLTAGE:

Alignment Point	Align for	Measuring Equipment Connection point	Measuring Equipment	Condition
RV-2 10K ohm (Semi-fixed V.R.)	6 V	+ side, TR4 2SC1226A Emitter (TP 9). - side, Ground.	0 to 10V DC Volt Meter	AC 117V 60 Hz

ALIGNMENT OF IC-1:

Alignment Point	Align for	Measuring Equipment Connection Point	Measuring Equipment	Condition
RV-1 10K ohm (Semi-fixed V.R.)	0.5 V	+ side, TP6 (IC-1 LA1201 Pin 4). - side, TP5 (IC-1 LA1201 Pin 6).	0 - 1.5 V DC Volt Meter (50K ohm/V)	Alignment to be made after alignment of stabilized power voltage.

ALIGNMENT OF IF CIRCUIT:

Alignment Point	Align for	Measuring Equipment Connection Point	Measuring Equipment	Condition
T4, T5, T6, T7 (455 KHz IF Trans.)	455 KHz	Input TP3 (TR2 2SC829 // 2SC1032 Base). Output TP7 (TR3 2SC829 // 2SC1032 Base).	Sweep Generator 455 KHz	Note 1 – 5 Fig. 7 – 9
T1, T2, T3 (10.7 MHz IF Trans.)	10.7 MHz	Input TP1 (P.C.B. "IF IN"). Output TP7 (TR3 2SC829 // 2SC1032 Base).	Sweep Generator 10.7 MHz	Note 1 – 5 Fig. 8 – 9

Note 1 : Disconnect Front-end (VHF) IF output leads from VHF and UHF tuner (at Front-end).

Note 2 : Output impedance of the sweep generator to be 50 or 75 ohms.

Note 3 : Capacitor $0.001\mu\text{F}$ to be inserted in series when the sweep generator is connected to input TP1 or TP3.

Note 4 : Detector probe to be connected to the oscilloscope input.

455 KHz ALIGNMENT:

Repeat alignment of T4, T5 and T7 to obtain wave shape shown in Fig. 7 which is symmetric to 455 KHz center. Symmetric wave shape must be aligned for maximum. T6 to be aligned to obtain maximum level.

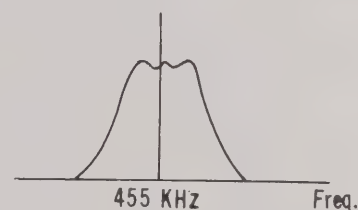


FIGURE 7

10.7 MHz ALIGNMENT:

Repeat alignment of T1, T2 and T3 to obtain wave shape shown in Fig. 8 which is symmetric to 10.7 MHz center. Symmetric wave shape must be aligned for maximum, however do not align T4, T5 and T6 while aligning T1, T2 and T3.



FIGURE 8

Note 5 : In the above-mentioned alignment procedure, the valley of wave shape to be aligned not to exceed 6 db as shown below.

DISCRIMINATOR COIL ALIGNMENT:

Alignment Point	Align for	Measuring Equipment Connection Point	Measuring Equipment	Condition
T8	S Curve Max.	Input TP7, TR3 2SC829 // 2SC1032 Base. Output TP8, IF Audio Output.	Sweep Generator (455 KHz)	Note 6 – 8
T9	Zero Point at 455 KHz	Same as above		Fig. 10

Note 6 : Disconnect Front-end (VHF, UHF) IF output leads from VHF and UHF tuner (at Front-end).

Note 7 : Output impedance of the sweep generator to be 50 or 75 ohms.

Note 8 : Capacitor $0.001\mu\text{F}$ to be inserted in series when the sweep generator is connected to input TP 7.

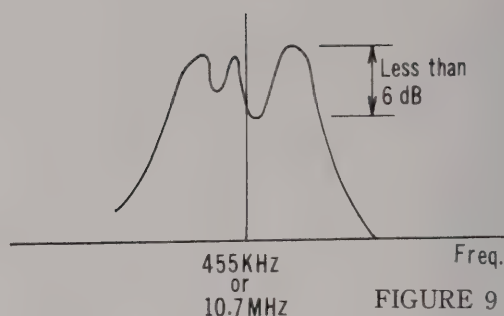


FIGURE 9

“S” CURVE ALIGNMENT:

Align T9 so that 455KHz marker on S curve may come across pedestal line (zero point).

Align T8 and T9 so that symmetric S curve (maximum linear portion) can be obtained.

Repeat the above-mentioned steps until proper S curve can be obtained.

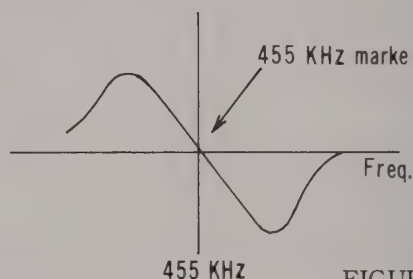


FIGURE 10

IF COIL ALIGNMENT IN FRONT-END

Alignment Point	Align for	Measuring Equipment Connection Point	Measuring Equipment	Condition
VHF low Band T405	10.7MHz	Input TP402, TR404 2SC722 Base. Output TP7, TR3 2SC829 // 2SC1032 Base.	Sweep Generator 10.7 MHz	Note 1-5 Note 9-10 Fig. 8-9
VHF hi Band T405		Input TP401, TR402 2SC722 Base. Output TP7, TR3 2SC829 // 2SC1032 Base.		
UHF Band T504		Input TP502, TR504 2SC722 Base. Output TP7, TR3 2SC829 // 2SC1032 Base.		

Note 9 : Connect IF cable to Front-end (VHF, UHF) IF output terminal.

Note 10: Disconnect crystal terminal lead (yellow) at Front-end.

ALIGNMENT:

Align Front-end IF coil to obtain maximum gain and wave shape shown in Fig. 8.

VHF – LOW FRONT-END ALIGNMENT:

Alignment point	Align for	Measuring Equipment Connection Point	Measuring Equipment	Condition
T406 Ant. Coil	35MHz (Note 14)	Input Ant. Terminal. Ant. Coil Primary.	VHF Signal Generator (Freq. 30 - 50MHz). High Freq. Volt Meter (Range 30 - 50MHz).	Note 11 - 13 (Fig. 11)
T407 R.F. Coil		Output TP402, TR404 2SC722 Base.		
T408 R.F. Coil				

Note 11 : Use the VHF signal generator (30 – 50MHz) provided with output $0.1\mu\text{V}$ to 100mV variable.

Note 12 : High freq. volt meter provided with freq. range 30-50MHz and input voltage range 1 - 10mV.

Note 13 : Preferably the receiver should be aligned with the range not to exceed 3mV.

Note 14 : Aligning frequency can be determined as follows :

- A) Receiving band width 4MHz.
- B) Aligning Freq. to be chosen to cover center of desired stations.
- C) Use circuits without taking off star marked capacitors, in case of 30 - 40MHz.
- D) Star marked capacitors to be eliminated when aligning frequencies are 40 - 50MHz range.

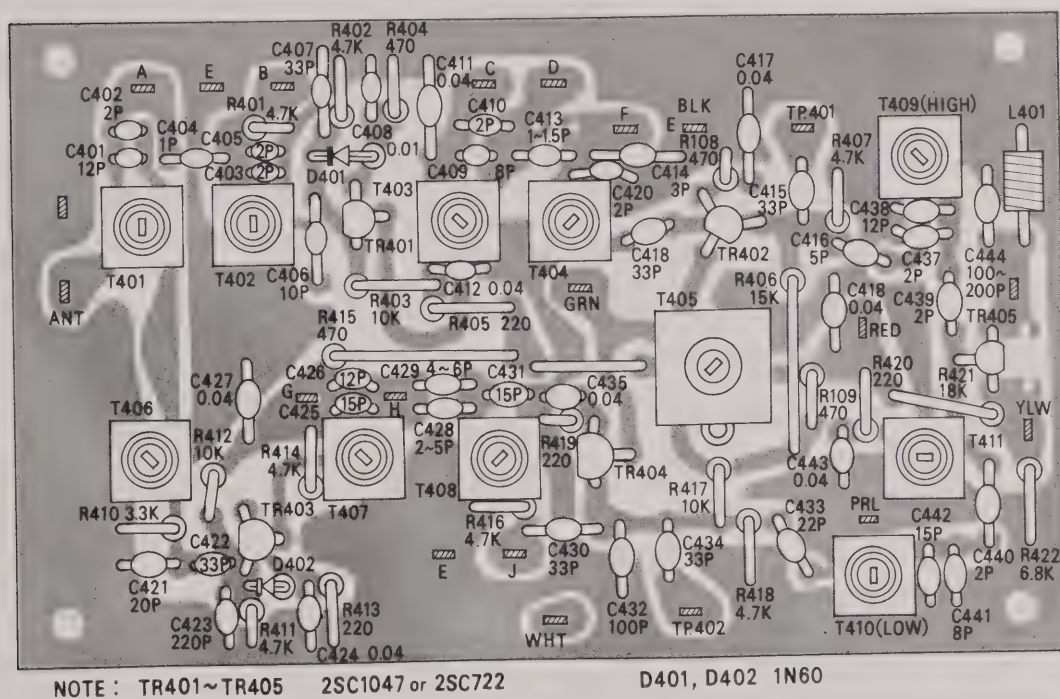


FIGURE 11 VHF LOW/HIGH BAND P.C.B.

ALIGNMENT:

- Step 1 : Connect the signal generator output to antenna input terminals, then set the signal generator frequency to aligning frequency.
- Step 2 : Connect the high frequency volt meter across TP402.
- Step 3 : Align T406 to obtain maximum output.
- Step 4 : Connect damping resistor (47 ohms) across terminal J-E, then align T407 to obtain maximum output.
Eliminate the resistor (47 ohms) after the alignment.
- Step 5 : Connect damping resistor (47 ohms) across terminal G-H, then align T408 to obtain maximum output.
Eliminate the resistor (47 ohms) after the alignment.
- Step 6 : Repeat step 3 thru step 5.

Note 15 : Connect all leads from main chassis to assigned terminals, IF output (green), +6V (red), crystal (yellow), ground (black), ground (purple), and antenna input (coaxial cable).

Note 16 : Provide 4 – 5 turns loop at end of frequency counter input cable as shown in Fig. 12, then close-couple to T411.

VHF – LOW OSCILLATOR ALIGNMENT:

Alignment Point	Adjust for	Measuring Equipment Connection Point	Measuring Equipment	Condition
T411, Osc Coil	35MHz (Note 14)	Freq. Counter, Coupling Loop, T411.	Signal Generator (Freq. 30 – 50MHz).	Note 15 – 16 (Fig. 12)
T410		Input Ant. Terminal. Output Ext. Speaker Jack.	Freq. Counter (Freq. 30 – 50MHz). Volt Meter (V.T.V.M.).	

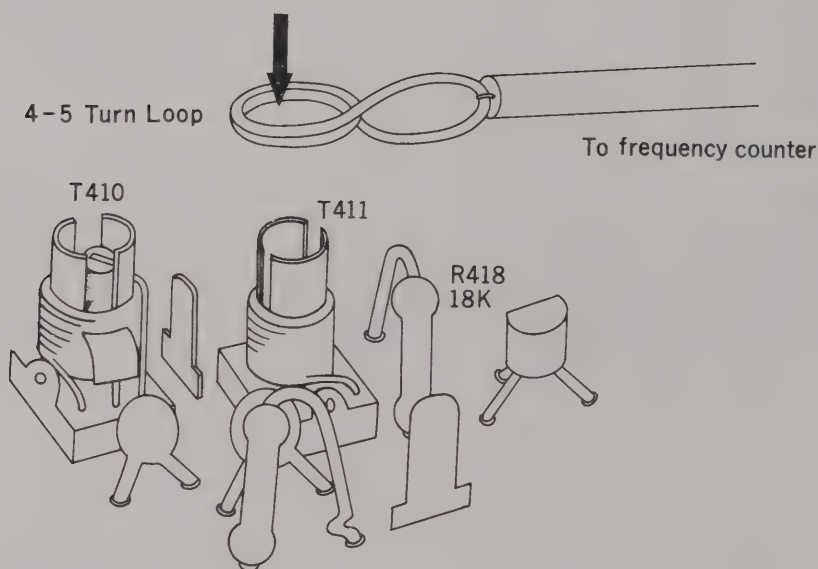


FIGURE 12 FREQUENCY COUNTER LOOP SET-UP

ALIGNMENT:

- Step 1 : Turn T411 core fully clockwise until it reaches the bottom of the coil.
- Step 2 : Confirm that on all channels (8 channels) the oscillator operates normally. If on any channels the oscillator is dead, align T411 core to obtain normal oscillation, then read out oscillator frequency by the frequency counter confirming that the frequency error is within 2/100,000.
- Step 3 : Set the signal generator frequency to 35MHz.
- Step 4 : Set channel to 35MHz crystal.
- Step 5 : Align T310 to obtain maximum sensitivity thru step 3 to step 4.

VHF HI FRONT-END ALIGNMENT :

Alignment Point	Align for	Measuring Equipment Connection Point	Measuring Equipment	Condition
T401 Ant. Coil T402 Ant. Coil T403 R.F. Coil T404 R.F. Coil	155MHz (Note 20)	Input Ant. Terminal, Ant. Coil T401. Output TP401, TR402 2SC722 Base.	Signal Generator (Freq. 150-174MHz). Hi Freq. Volt Meter (Range 150-174MHz).	Note 17 - 19 (Fig. 11)

Note 17 : Use the VHF signal generator (150 - 174MHz) provided with output of 0.1 μ V - 100mV variable.

Note 18 : High frequency volt meter should be provided with frequency range 150-174MHz and input voltage range 1 - 10mV.

Note 19 : Preferably the receiver to be aligned in range not to exceed 3mV.

Note 20 : Aligning frequency can be determined as follows :

- A) Receiving band-width 7MHz.
- B) Aligning frequency to be chosen to cover center of desired stations.
- C) Use all capacitors with star mark indicated in the schematic diagram (in case of 150 - 162MHz).
- D) However, star marked capacitors to be eliminated when aligning frequencies are 162 - 174MHz range.

ALIGNMENT:

Step 1 : Connect the signal generator output to antenna input terminal, then set the signal generator frequency to aligning frequency.

Step 2 : Connect the high frequency volt meter across TP401 and chassis ground.

Step 3 : Connect the damping resistor (47 ohms) across terminal B-E, then align T401 to obtain maximum output. Remove the resistor (47 ohms) after the above alignment.

Step 4 : Connect the damping resistor (47 ohms) across terminal A-E, then align T402 to obtain maximum level. Remove the resistor (47 ohms) after the alignment.

Step 5 : Connect the damping resistor (47 ohms) across terminal F-E, then align T403 to obtain maximum level. Remove the resistor after the alignment.

Step 6 : Connect the damping resistor (47 ohms) across terminal C-D, then align T404 to obtain maximum level. Remove the resistor after the aligning.

Step 7 : Repeat Step 3-6 until the proper wave shape and output are obtained.

VHF HI OSCILLATOR ALIGNMENT:

Alignment Point	Align for	Measuring Equipment Connection Point	Measuring Equipment	Condition
T411 Osc Coil	155MHz (Note 20)	Freq. Counter, Loop T411.	Signal Generator (Freq. 150 - 174MHz).	Note 21 - 22
T409 Tripler Coil		Input Ant. Input Terminal. Output Ext. Speaker Jack.	Frequency Counter (Freq. 40 - 60 MHz). Volt Meter (V.T.V.M.).	

Note 21 : Connect all leads from main chassis to assigned terminals, IF output (green), +6V(red), crystal (yellow), grounding (black), ground (purple), and antenna input (coaxial cable).

Note 22 : Provide 4 –5 turns loop at end of frequency counter input cable as shown in Fig. 12, then close-couple to T411, as shown.

ALIGNMENT:

Step 1 : Turn T406 core fully clockwise until it reaches the bottom of the coil.

Step 2 : Confirm that on all channels (8 channels) the oscillator operates normally. If on any channels the oscillator is dead, align T411 core to obtain normal oscillation, then read out oscillator frequency on the counter confirming that frequency error is within 2/100,000.

Step 3 : Set the signal generator frequency to 155MHz.

Step 4 : Set channel to 155MHz crystal.

Step 5 : Align T409 to obtain maximum sensitivity thru step 3 – 4.

UHF FRONT-END ALIGNMENT:

Alignment Point	Align for	Measuring Equipment Connection Point	Measuring Equipment	Condition
T.C. 501	463MHz	Input Ant. Terminal.	Signal Generator (Freq. 450 – 470MHz).	Note 23 – 26 (Fig. 13)
T.C. 502		Output R.F. Output (IF).	High Freq. Volt Meter (Range 450 – 470MHz).	
T.C. 503				

Note 23 : Use the UHF signal generator (450–470MHz) provided with output of $0.1\mu\text{V}$ – 100mV variable.

Note 24 : Set the signal Generator frequency to 463MHz and the output to 100mV.

Note 25 : The high freq. volt meter to be provided with freq. range 450 – 470MHz, and 1 – 10mV in output range.

Note 26 : The high frequency volt meter to be connected to RF output of UHF Front-end which is terminated with 47 ohms.

ALIGNMENT:

Step 1 : Connect the capacitor of 500pF (damping capacitor) across trimmer capacitor T.C.503.

Step 2 : Align T.C.502 to obtain maximum deflection on the voltmeter.

Step 3 : Align T.C.501 (trimmer) to obtain maximum deflection on the voltmeter.

Step 4 : Eliminate 500pF capacitor from T.C.503, then connect it to T.C.502.

Step 5 : Align T503 trimmer capacitor to obtain maximum deflection on the voltmeter. Eliminate 500pF capacitor from T.C.502 after aligning.

Step 6 : Repeat step 1 thru step 5 until proper characteristics are obtained.

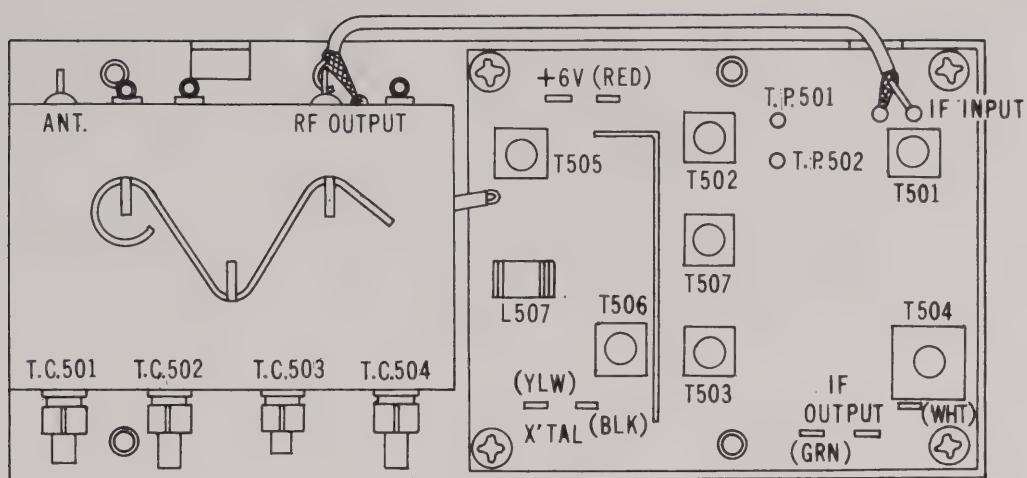


FIGURE 13 UHF FRONT-END

UHF IF ALIGNMENT :

Alignment Point	Align for	Measuring Equipment Connection Point	Measuring Equipment	Condition
T507 Trap Coil	90.46MHz	Input X'tal Terminal Output T. P. 502	Signal Generator (Freq. 50 - 100MHz).	Note 27 - 28
T501 IF Coil	55.93MHz	Input IF—in	High Freq. Voltmeter (Range 50 - 100MHz).	
T502 IF Coil		Output TR504,2SC722 Base		
T503 IF Coil				

UHF LOCAL ALIGNMENT :

Alignment Point	Align for	Measuring Equipment Connection Point	Measuring Equipment	Condition
T505 Tripler Coil	135.69MHz	Input X'tal terminal. Output C522, 2pF.	Signal Generator (Freq. 120 - 470MHz).	Note 29
T506 Osc. Coil		Freq. Counter, Loop T506	Freq. Counter (40 - 60MHz).	
TC504	463MHz	Input Ant. Terminal. Output Ext. Speaker Jack.	High Freq. Voltmeter (Range 120 - 470MHz).	

Note 27 : Use the VHF signal generator (50 - 100MHz) provided with 100mV output.

Note 28 : The high freq. voltmeter must be provided with freq. range 50-100MHz and input voltage range 1 - 10mV.

ALIGNMENT :

(A) Trap Coil (T507) Alignment

- Step 1 : Connect the signal generator to crystal terminal (yellow).
- Step 2 : Set the signal generator output level and its frequency to 100mV and 90.46MHz respectively.
- Step 3 : Connect the high freq. voltmeter to TP502. Align T507 to obtain minimum reading on the voltmeter.

(B) IF Alignment (UHF)

- Step 1 : Connect the signal generator to IF - IN (T501), and set the frequency and its output to 55.93MHz and 100mV respectively.
- Step 2 : Connect the high freq. voltmeter to TR504 2SC722 base.
- Step 3 : Connect the damping resistor (47 ohms) across TP502.
- Step 4 : Align T501, T502 in step 3 to obtain maximum reading on the voltmeter.
- Step 5 : Disconnect the damping resistor from TP502, then connect it to TP501.
- Step 6 : Align T503 in step 5 to obtain maximum reading on the voltmeter. Disconnect the damping resistor after the alignment.
- Step 7 : Repeat step 3 thru step 6 until proper characteristics are obtained.

(C) UHF Local Oscillator Alignment

- Step 1 : Connect the signal generator to crystal terminal (yellow). Frequency and output (unmodulated signal) to be set to 135.69MHz and 100mV respectively.
- Step 2 : Connect high freq. voltmeter to C522 2pF, then align T505 to obtain maximum reading on the voltmeter.
- Step 3 : Turn T506 core clockwise until the core reaches the bottom of T506.
- Step 4 : Confirm the local oscillation of all 8 channels by frequency-counter. If all channel oscillation fails, adjust the core to oscillate all channels. Oscillation frequency error must be within 1/100,000.
- Step 5 : Set the signal generator frequency to 463MHz, then the receiver channel to 463MHz.
- Step 6 : In step 3, align T.C. 504 to obtain maximum sensitivity.

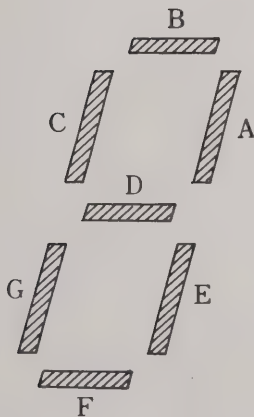
Note 29 : Provide 4 – 5 turns loop at end of frequency counter input cable as shown in Fig. 11 and close-couple to T506.

LOGIC CIRCUIT CHECK :

Refer the below-indicated table when logic circuit parts are replaced.

CH	Signal: Flip-flop									Signal: logic circuit								Input: Channel indicator						
No.	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	A	B	C	D	E	F	G
1	☐	☐	☒	☐	☒	☐	☒	☐	☒	☐	☒	☒	☒	☒	☒	☒	☒	☒	☒	☐	☒	☒	☒	☒
2	☐	☒	☐	☐	☒	☐	☒	☐	☒	☒	☐	☒	☒	☒	☒	☒	☒	☒	☒	☒	☐	☒	☐	☒
3	☐	☐	☒	☒	☐	☐	☒	☐	☒	☒	☒	☐	☒	☒	☒	☒	☒	☒	☒	☒	☐	☒	☐	☒
4	☐	☒	☐	☒	☐	☐	☒	☐	☒	☒	☒	☒	☐	☒	☒	☒	☒	☒	☒	☒	☐	☒	☐	☒
5	☐	☐	☒	☐	☒	☒	☐	☐	☒	☒	☒	☒	☒	☐	☒	☒	☒	☒	☒	☐	☒	☐	☒	☒
6	☐	☒	☐	☐	☒	☒	☐	☐	☒	☒	☒	☒	☒	☒	☐	☒	☒	☒	☒	☒	☐	☒	☐	☒
7	☐	☐	☒	☒	☐	☒	☐	☐	☒	☒	☒	☒	☒	☒	☒	☐	☒	☒	☒	☒	☐	☒	☐	☒
8	☐	☒	☐	☒	☐	☒	☐	☐	☒	☒	☒	☒	☒	☒	☒	☒	☐	☒	☒	☒	☒	☐	☒	☐
9	☐	☐	☒	☐	☒	☐	☒	☒	☐	☐	☒	☒	☒	☒	☒	☒	☒	☒	☒	☐	☒	☐	☒	☒
10	☐	☒	☐	☐	☒	☐	☒	☒	☐	☒	☐	☒	☒	☒	☒	☒	☒	☒	☒	☒	☐	☒	☐	☒
11	☐	☐	☒	☒	☐	☐	☒	☒	☐	☒	☒	☐	☒	☒	☒	☒	☒	☒	☒	☒	☐	☒	☐	☒
12	☐	☒	☐	☒	☐	☐	☒	☒	☐	☒	☒	☒	☐	☒	☒	☒	☒	☒	☒	☒	☐	☒	☐	☒
13	☐	☐	☒	☐	☒	☒	☐	☒	☐	☒	☒	☒	☒	☐	☒	☒	☒	☒	☒	☐	☒	☐	☒	☒
14	☐	☒	☐	☐	☒	☒	☐	☒	☐	☒	☒	☒	☒	☒	☐	☒	☒	☒	☒	☒	☐	☒	☐	☒
15	☐	☐	☒	☒	☐	☒	☐	☒	☐	☒	☒	☒	☒	☒	☒	☐	☒	☒	☒	☒	☐	☒	☐	☒
16	☐	☒	☐	☒	☐	☒	☐	☒	☐	☒	☒	☒	☒	☒	☒	☒	☐	☒	☒	☒	☒	☐	☒	☐

FIGURE 14



- Remarks :
- (1) In the above table, the test point number is applied to the horizontal axis, and the channel number is applied to the vertical axis.
 - (2) The marks O in the table show a test terminal at a voltage of 2 V or more.
 - (3) The marks X in the table show a test terminal at a voltage of 0.5 V or less.
 - (4) The voltage must be measured by using a voltmeter with internal resistance of 20 K ohms/V.
 - (5) Each segment number of the channel indicator is as follows:

DIGI SCAN-16 PARTS LIST

DESCRIPTION	DESIGNATION	UNIMETRICS PART #
<u>HARDWARE</u>		
Indication apparatus holder		10-190
Spacer L		10-191
Spacer M		10-192
Decoration Washer		10-193
Rubber foot		10-194
Crystal Holder Moldplane (A)		10-195
Lead Holder		10-196
Felt clip		10-197
Fuse holder	PF001	10-198
Washer	SN + 3006	10-199
Washer	SN + 3010	10-200
Washer	SN + 4006	10-201
Washer	SN + 3008	10-202
Washer	BN + 2006	10-203
Washer	SS + 3005	10-204
Washer	SS + 3008	10-205
Washer	SS + 4010	10-206
Hexagonal nut	NMB 303	10-207
Hexagonal nut	NMB 403	10-208
Flat washer	ZS 301	10-209
Flat washer	ZS 401	10-210
Flat washer	3.2 ϕ $\times$ 8 ϕ $\times$ 0.5t	10-211
Spring washer	VS 302	10-212
Spring washer	VS 402	10-213
Spring washer	VS 202	10-214
Fiber washer	3.5 ϕ $\times$ 8 ϕ $\times$ 2t	10-215
Washer	SN + 3006	10-216
Flat washer	ZS 301	10-217
Spring washer	VS 302	10-218
Lead holder		10-219
Hexagonal nut	NMB 303	10-220
Flat washer	ZS 301	10-221
Spring washer	VS 302	10-222
<u>COILS & TRANSFORMERS</u>		
Power transformer	T11	20-160
Input transformer	T12	20-161
Low frequency choke coil	CT-1	20-162
Intermediate freq. transformer	T1	20-163
Intermediate freq. transformer	T2	20-164
Intermediate freq. transformer	T3	20-165

DESCRIPTION	DESIGNATION	UNIMETRICS PART #
Intermediate freq. transformer	T6	20-166
Intermediate freq. transformer	T4, 7	20-167
Intermediate freq. transformer	T5	20-168
Intermediate freq. transformer	T8	20-169
Intermediate freq. transformer	T9	20-170
Transformer for MPX	T13	20-171
RF coil (UHF) A	T501	20-172
RF coil (UHF) B	T502	20-173
RF coil (UHF) C	T503	20-174
Osc. coil (UHF)	T506	20-175
Doubler coil (UHF) A	T505	20-176
Trap coil A	T507	20-177
Trap coil C	L506	20-178
Intermediate freq. transformer	10 K type 10.7 MHz T405	20-179
Antenna coil (B)	T402	20-180
Antenna coil (C)	T406	20-181
RF coil (D)	T401, T403	20-182
RF coil (E)	T404	20-183
RF coil (F)	T407	20-184
RF coil (G)	T408	20-185
Osc. coil	T411	20-186
Doubler coil (B)	T409	20-187
Doubler coil (C)	T410	20-188
Trap coil	L401	20-189

GENERAL

Panel	30-330
Chassis	30-331
Sub panel (B)	30-332
Tuner mount (A)	30-333
Cover C	30-334
Cover E	30-335
Crystal Lid (A)	30-336
Power transformer mounting plate	30-337
Hanger	30-338
Heat sink (Small)	30-339
L Shaped metal	30-340
Catch metal	30-341
Name plate	30-342
Model plate	30-343
FCC name plate	30-344
Freq. label	30-345
Channel card	30-346
Number label	30-347
Label	30-348
Acryl panel	30-349

DESCRIPTION	DESIGNATION	UNIMETRICS PART #
Adhesive tape for panel (A)		30-350
Knob R		30-351
Knob (Small)		30-352
Knob P		30-353
Lamp cover		30-354
Dual lamp cover		30-355
Illumination plate		30-356
Master carton		30-357
Individual carton		30-358
Inner buffer		30-359
Polyethelene bag for mainbody		30-360
Polyethelene bag for instruction manual		30-361
Polyethelene bag for power cord		30-362
Polyethelene bag for hanger		30-363
Polyethelene bag for accessory		30-364
P.C. Board		30-365
Crystal P.C.B.		30-366
Fuse	1 A	30-367
Fuse	1.5 A	30-368
Seesaw switch	S-1, 2	30-369
Push switch	S-3	30-370
Slide switch	S-4	30-371
Slide switch	S-5, 6	30-372
Indication device		30-373
Pilot lamp		30-374
Phone jack		30-375
4F type plug		30-376
4F type jack		30-377
Speaker		30-378
Closed terminal		30-379
Coaxial cable connector	ANT A, B	30-380
Crystal socket	S-14 12P	30-381
Crystal socket	S-14 3P	30-382
Testing point terminal	T.P1-26	30-383
Crystal	X-17	30-384
Terminal strip		30-385
Ceramic filter		30-386
Power cord		30-387
Power cord assembly		30-388
DC cord		30-389
DC cord assembly		30-390
Coaxial cable connector with lead		30-391
Connector with Vinyl lead		30-392
P.C. Board (UHF)		30-393

DESCRIPTION	DESIGNATION	UNIMETRICS PART #
UHF tuner		30-394
UHF tuner main body		30-395
UHF partition plate A		30-396
Partition plate B		30-397
Partition plate C		30-398
UHF tuner cover		30-399
UHF tuner spring		30-400
UHF tuner mounting plate		30-401
UHF shield plate		30-402
Testing point terminal	IP connector	30-403
Testing point terminal	R-S 3232	30-404
Cylinder trimmer		30-405
VHF tuner P.C.B.		30-406
TRANSISTORS		
Transistor	TR1, 2, 3, 6, 17, 18, 47-52	2SC1032/2SC829
Transistor	TR4, 14, 15	2SC1226A
Transistor	TR5, 10, 19-26, 27-42, 43, 44, 45, 46, 53-59	2SC711/2SC828
Transistor	TR7, 8, 9, 11, 12, 13, 16	2SC829/2SC1032
Transistor	TR401, 402, 403, 404, 405	2SC722/2SC1047
Transistor	TR501, 502	2SC683
Transistor	TR503, 504, 505, 506	2SC1047/2SC722
Varistor	VS-1, 2	1S1209
I.C.	IC-1	LA-1201
DIODES		
Diode	D3-6	FR-2-2
Diode	D1-2	1S34
Diode	D7-54	1S1588
Diode	UHF band D501	SD-82A
Diode	VHF tuner D401, 402	1N60 × 2
RESISTORS		
Variable resistor	RV3	5 K ohm
Variable resistor	RV4	5 K ohm
Dual variable resistor	RV5	10 K ohm × 2
Semi-fixed variable resistor	RV1, 2	10 K ohm
Carbon resistor	R24, 48	10 ohm
Carbon resistor	R33, 51, 53, 65	68 ohm
Carbon resistor	R10, 12, 16, 18, 19	100 ohm
Carbon resistor	R13, 49, 56	150 ohm
Carbon resistor	R47	220 ohm
Carbon resistor	R50, 52	330 ohm
Carbon resistor	R6, 17	470 ohm
Carbon resistor	R3, 4, 7, 20, 23, 26, 34, 42, 44, 59, 71, 76, 77 82, 83, 88, 89, 94, 115-122, 131-138, 168	1 K ohm

DESCRIPTION	DESIGNATION	UNIMETRICS PART #
Carbon resistor	R11, 28	1.5 K ohm
Carbon resistor	R43	2.2 K ohm
Carbon resistor	R14, 21, 22, 25, 38, 39, 66, 69, 72, 75, 78 81, 84, 87, 90, 93	3.3 K ohm
Carbon resistor	R1, 5, 35, 36, 41, 58, 60, 165	4.7 K ohm
Carbon resistor	R9, 104, 102, 97, 98	6.8 K ohm
Carbon resistor	R2, 6, 27, 29, 32, 45, 73, 74, 79, 80, 85, 86 91, 92, 140, 144, 148, 152, 156, 160	10 K ohm
Carbon resistor	R37, 67, 68	12 K ohm
Carbon resistor	R40, 57, 95, 96, 99, 100, 101, 103, 105, 106	15 K ohm
Carbon resistor	R15, 31, 46, 61, 62, 142, 146, 150, 154, 158 162	22 K ohm
Carbon resistor	R30, 63, 64, 107—114, 123—130, 141, 145 149, 153, 157, 161	33 K ohm
Carbon resistor	R70	220 K ohm
Solid resistor	R139, 143, 147, 151, 155, 159, 163	470 ohm
Wounded resistor	R54, 55	0.4 ohm
Carbon resistor	R504	100 ohm
Carbon resistor	R501	330 ohm
Carbon resistor	R506	3.3 K ohm
Carbon resistor	R503	4.7 K ohm
Carbon resistor	R502	10 K ohm
Carbon resistor	R505	12 K ohm
Carbon resistor	R510, 521	100 ohm
Carbon resistor	R166, 167	680 ohm
Carbon resistor	R518	220 ohm
Carbon resistor	R514	330 ohm
Carbon resistor	R509, 513	1 K ohm
Carbon resistor	R520	3.3 K ohm
Carbon resistor	R507, 511	4.7 K ohm
Carbon resistor	R523	6.8 K ohm
Carbon resistor	R508, 512	10 K ohm
Carbon resistor	R519, 522	15 K ohm
Carbon resistor	R405, 413, 419, 420	220 ohm
Carbon resistor	R404, 408, 409, 415	470 ohm
Carbon resistor	R410	3.3 K ohm
Carbon resistor	R401, 402, 407, 411, 414, 416, 418	4.7 K ohm
Carbon resistor	R422	6.8 K ohm
Carbon resistor	R403, 412, 417	10 K ohm
Carbon resistor	R406	15 K ohm
Carbon resistor	R421	18 K ohm

CAPACITORS

Electrolytic capacitor	C58, 59	3.3 μ F/25 V
Electrolytic capacitor	C17, 35, 37—39, 55, 57	4.7 μ F/25 V

DESCRIPTION	DESIGNATION	UNIMETRICS PART #
Electrolytic capacitor	C41, 43, 68	10 μ F/25 V
Electrolytic capacitor	C44	33 μ F/6.3 V
Electrolytic capacitor	C23	33 μ F/16 V
Electrolytic capacitor	C26, 45	100 μ F/16 V
Electrolytic capacitor	C51	220 μ F/16 V
Electrolytic capacitor	C25	470 μ F/16 V
Electrolytic capacitor	C27, 28	1000 μ F/25 V
Mylar capacitor	C54	0.0022 50 V
Mylar capacitor	C52, 53	0.0047 50 V
Mylar capacitor	C42, 56	0.047 50 V
Mylar capacitor	C40	0.1 50 V
Titanium capacitor	C1	1 pF
Titanium capacitor	C3	1.5 pF
Titanium capacitor	C73-80, 82-89	15 pF
Titanium capacitor	C9	33 pF
Titanium capacitor	C31, 33	51 pF
Titanium capacitor	C15	68 pF
Titanium capacitor	C32	500 pF
Titanium capacitor	C2, 4	220 pF
Titanium capacitor	C5-7, 22, 24	0.01 μ F
Titanium capacitor	C13	0.02 μ F
Titanium capacitor	C36	0.03 μ F
Titanium capacitor	C8, 10-12, 14, 16, 18-21, 29, 30, 34 46-50, 60-67, 69-72, 81, 90	0.04 μ F
Trimmer capacitor	CT1-16	1ZE10P50 10 pF
Ceramic capacitor	C515, 518, 524	0.02 μ F
Ceramic capacitor	C521, 528, 535, 533	0.04 μ F
Titanium capacitor	C523, 529	FC-50 020 C
Titanium capacitor	C517, 525	030 C
Titanium capacitor	C522	180 K
Titanium capacitor	C516	220 K
Titanium capacitor	C513, 519, 531, 501	330 K
Titanium capacitor	C527	FC-70 820 K
Titanium capacitor	C514, 520	101 K
Titanium capacitor	C526	FC-80 151 K
Titanium capacitor (Temp. comp.)	C502, 506, 507, 509	USDO4JPH020 C
Titanium capacitor (Temp. comp.)	C530	USDO8JRH 330 K
Earthing capacitor	C508	25 pF 50 V
Earthing capacitor	C503, 510	1000 pF 50 V
Disc through type capacitor	C504, 505, 511	CK47-132FIH102PZ
Titanium capacitor	C408	0.01 μ F
Titanium capacitor	C411, 412, 417, 419, 424, 427, 435, 436	0.04 μ F
Titanium capacitor	C404	1 pF
Titanium capacitor	C402, 403, 405, 410, 413, 420, 437, 439, 440	2 pF

DESCRIPTION	DESIGNATION	UNIMETRICS PART #
Titanium capacitor	C414, 428	3 pF
Titanium capacitor	C416	5 pF
Titanium capacitor	C429	6 pF
Titanium capacitor	C441, 409	8 pF
Titanium capacitor	C406	10 pF
Titanium capacitor	C401, 426, 438	12 pF
Titanium capacitor	C425, 431, 442	15 pF
Titanium capacitor	C421	20 pF
Titanium capacitor	C433	22 pF
Titanium capacitor	C407, 415, 418, 422, 430, 434, 446	33 pF
Titanium capacitor	C432	100 pF
Titanium capacitor	C444	150 pF
Titanium capacitor	C423	220 pF

TUNER CONNECTING METHOD

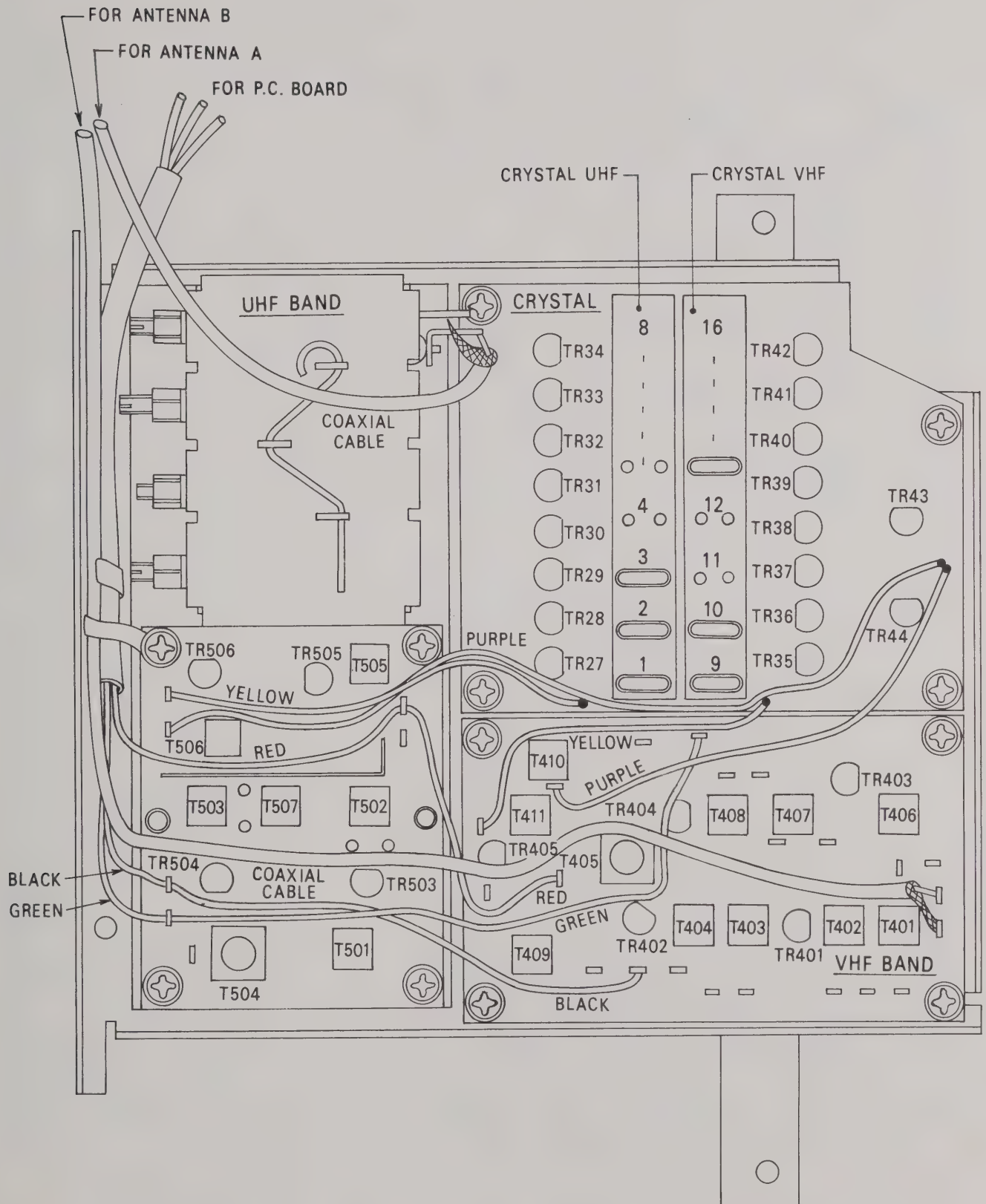


FIGURE 15

36



MAIN BOARD

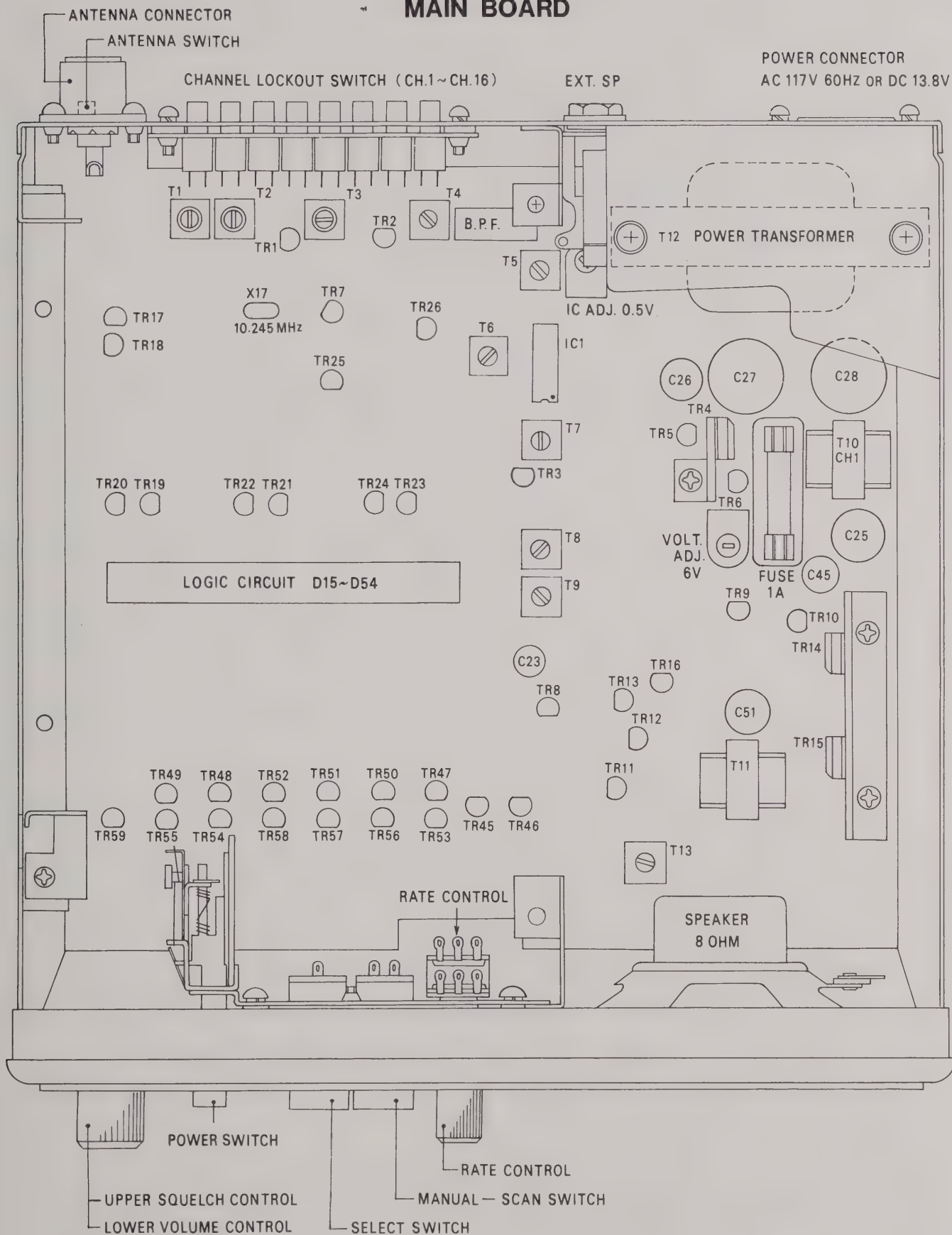


FIGURE 17

MAIN BOARD

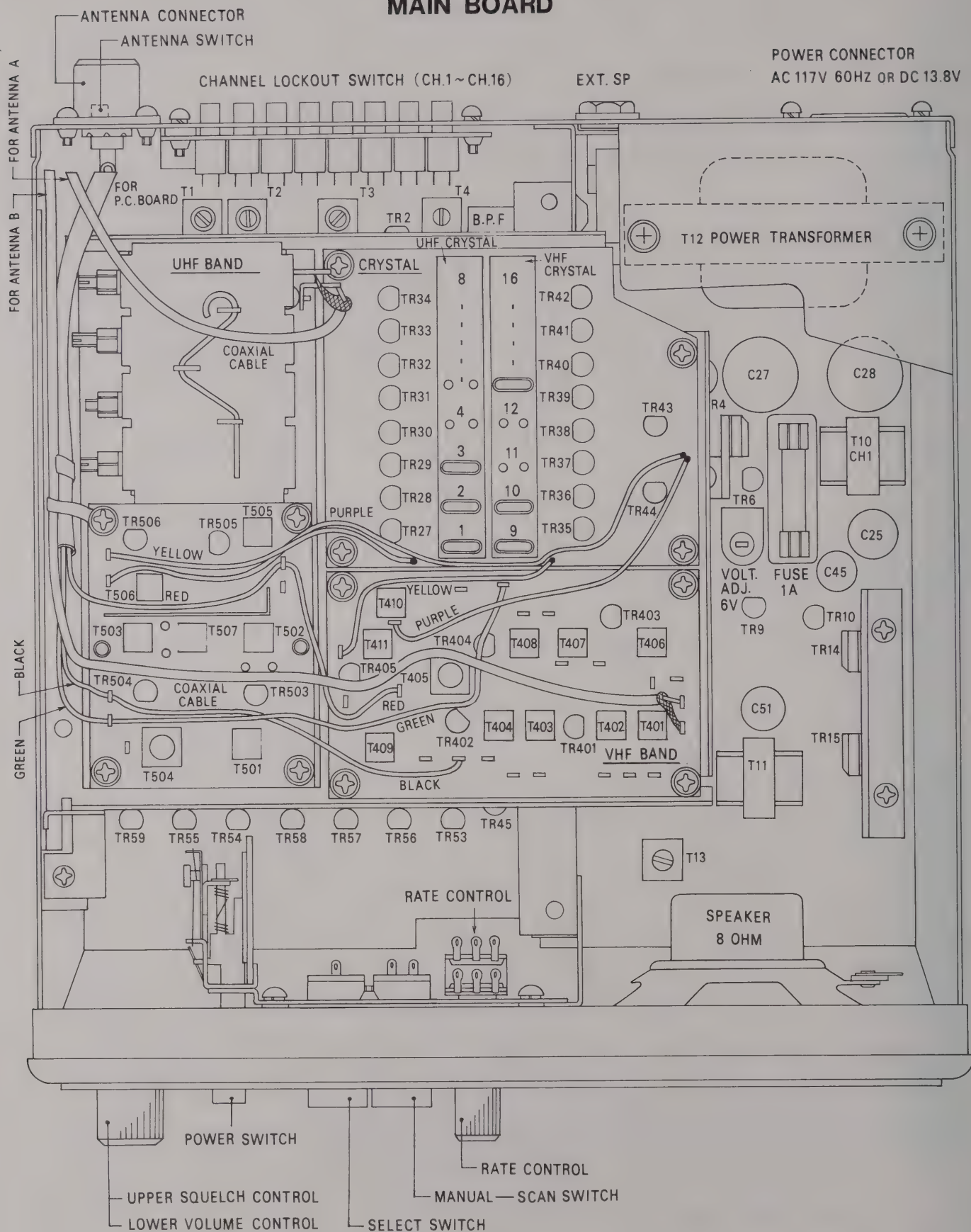


FIGURE 18

UHF BAND P.C.B.

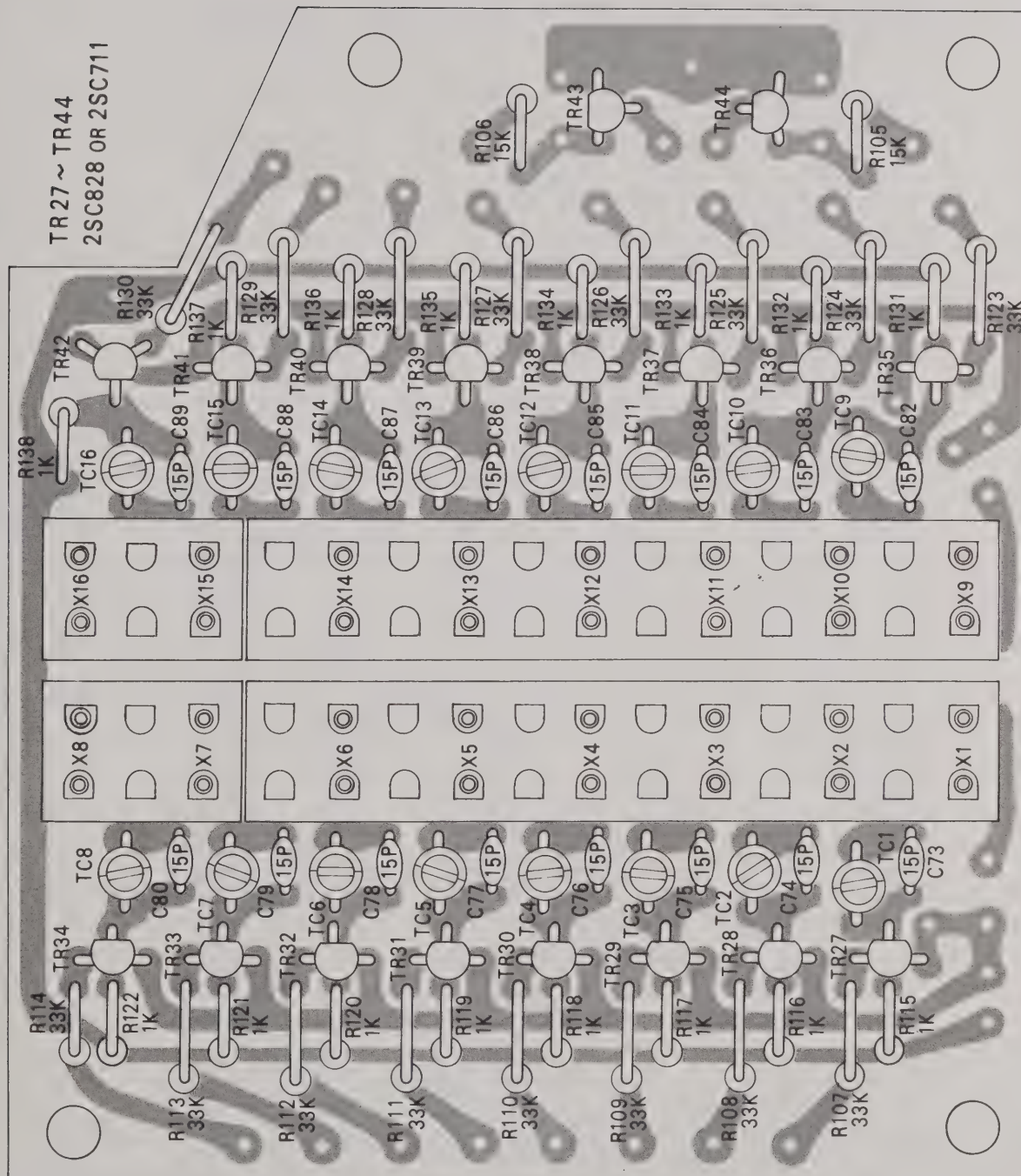
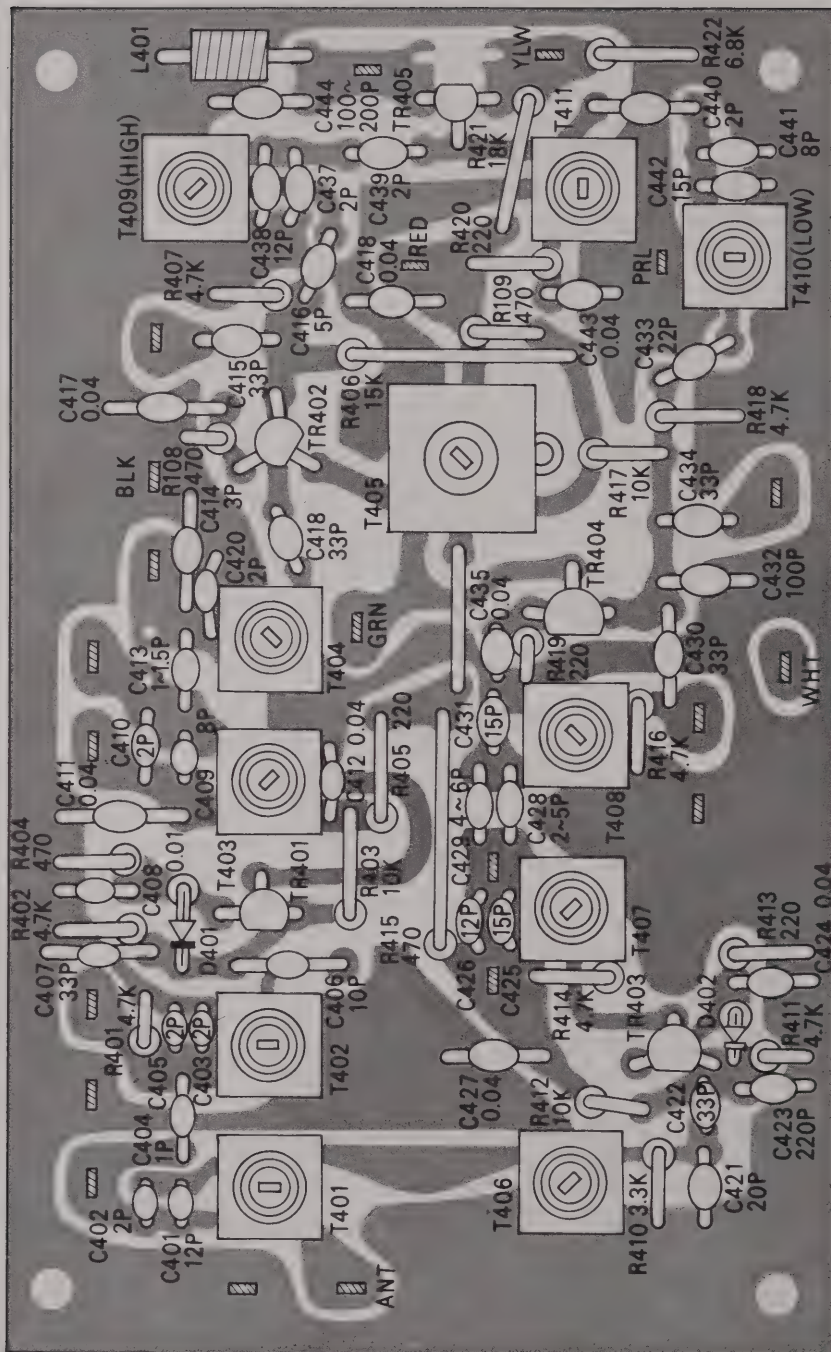


FIGURE 19



NOTE : TR401~TR405 2SC1047 D401, D402 1N60

FIGURE 20

BLOCK DIAGRAM

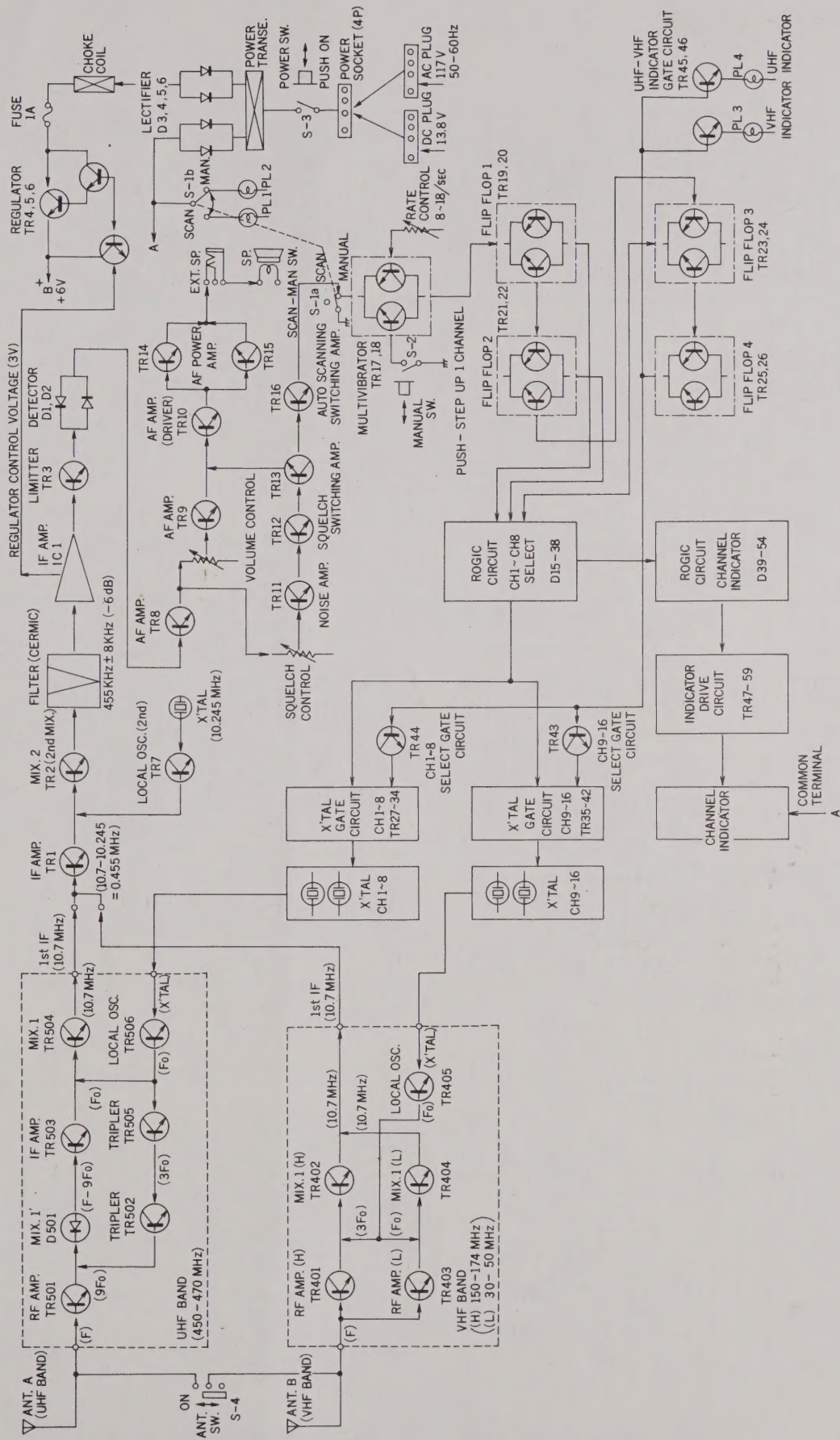
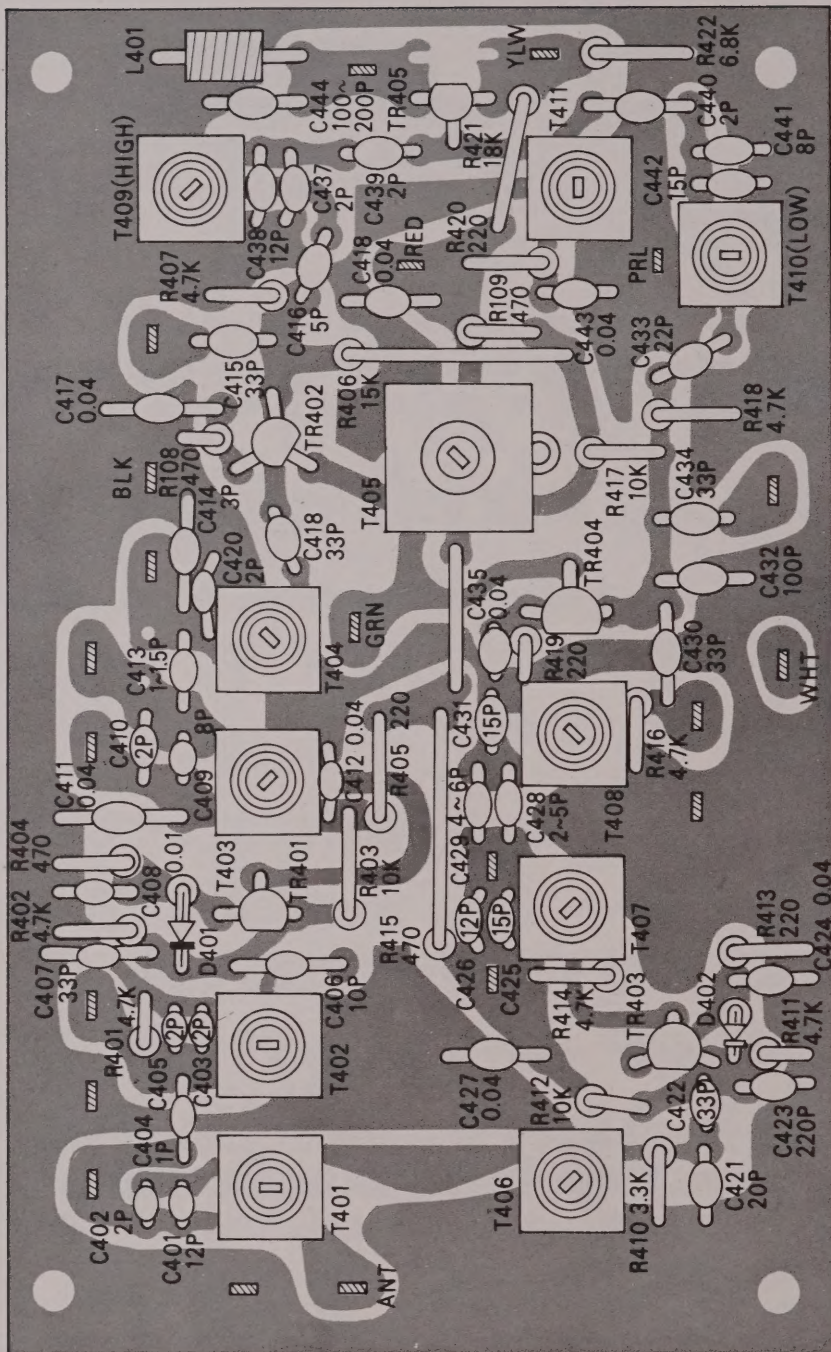


FIGURE 22

VHF LOW/HIGH BAND P.C.B.



NOTE: TR401~TR405 2SC1047 D401, D402 1N60

FIGURE 20

SCHEMATIC DIAGRAM

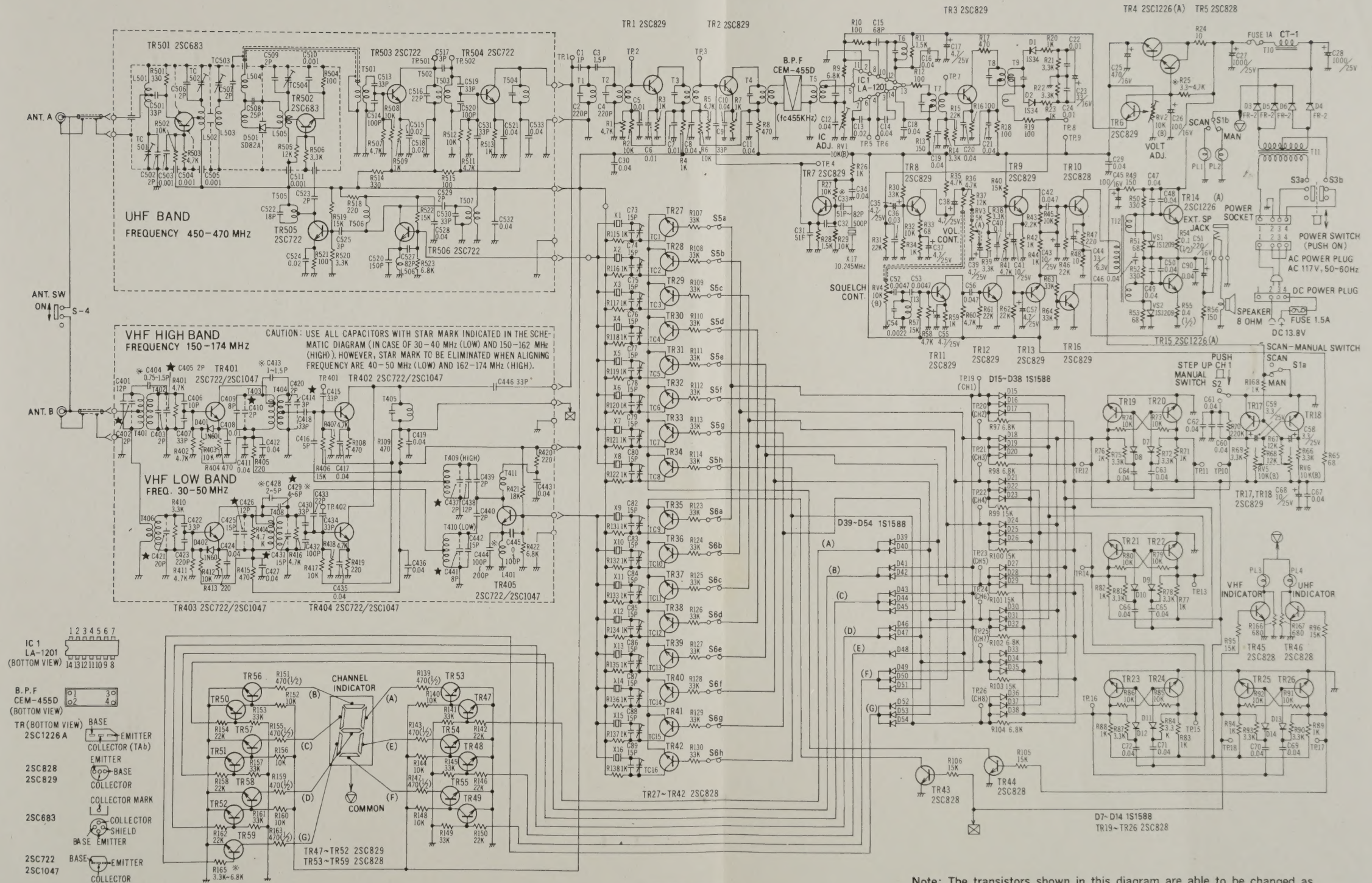


FIGURE 21

Note: The transistors shown in this diagram are able to be changed as follows; 2SC828/2SC711, 2SC829/2SC1032, 2SC722/2SC1047

UNIMETRICS, INC.

23 West Mall, Plainview N. Y. 11803

Printed in Japan